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ABSTRACT

This document, an inquiry-based curriculum supplement that includes materials for both teachers and students, is designed to develop an understanding among students about oral health. Contents include: (1) "About the National Institutes of Health"; (2) "About the National Institute of Dental and Craniofacial Research"; (3) "Introduction to Open Wide and Trek Inside"; (4) "Implementing the Module"; (5) "Using the CD-ROM"; (6) "Using the Student Lessons"; and (7) "Student Lessons". Lesson plans include: (1) "What Do Mouths Do?"; (2) "Open Wide! What's Inside?"; (3) "Let's Investigate Tooth Decay!"; (4) "What Lives Inside Your Mouth?"; (5) "What Keeps Your Mouth Healthy?"; and (6) "What Have You Learned about the Mouth?" This curriculum supplement contains several activities that can be used in sequence or as individual activities designed to fit into 45 minutes of classroom time. The printed version may be used in isolation or in conjunction with the CD-ROM, which offers video clips, animations, simulations, and interactive games relating to the lesson material presented in the text. Also included in the document are: Additional Resources for Teachers; a Glossary; Masters; and Masters in Spanish. (Contains 13 references.) (YDS)

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ED 464 818

NIH Curriculum Supplement Series
Grades 1-2

Open Wide and Trek Inside

National Institutes of Health

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Open Wide and Trek Inside

under a contract from the
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Foreword

This curriculum supplement, from *The NIH Curriculum Supplements Series*, brings cutting-edge medical science and basic research discoveries from the laboratories of the National Institutes of Health (NIH) into classrooms. As the largest medical research institution in the United States, NIH plays a vital role in the health of all Americans, and seeks to foster interest in research, science, and medicine-related careers for future generations. NIH's Office of Science Education (OSE) is dedicated to promoting science education and scientific literacy.

We designed this curriculum supplement to complement existing life science curricula at both the state and local levels, and to be consistent with the *National Science Education Standards*.[1] It was developed and tested by a team composed of teachers from across the country, scientists, medical experts, and other professionals with relevant subject-area expertise from institutes and medical schools across the country, an NIH scientist or representative from each of the 25 institutes, and curriculum design experts from Biological Sciences Curriculum Study (BSCS) and Videodiscovery. The authors incorporated real scientific data and actual case studies into classroom activities. A three-year development process included geographically dispersed field tests by teachers and students.

The structure of this module enables teachers to effectively facilitate learning and stimulate student interest by applying scientific concepts to real-life scenarios. Design elements include a conceptual flow of lessons based on BSCS's 5E Instructional Model of Learning, multi-subject-integration emphasizing cutting-edge science content, and built-in assessment tools. Activities promote active and collaborative learning and are inquiry-based to help students develop problem-solving strategies and critical thinking.

NIH will release new supplements each year targeting students between grades K–12. Each curriculum supplement comes with a complete set of materials for both teachers and students including printed materials, extensive background and resource information, and a CD-ROM with videos and interactive activities. These supplements are distributed at no cost to teachers across the United States. All materials may be copied for classroom use, but may not be sold. We welcome feedback from our users. For a complete list of curriculum supplements, updates, availability and ordering information, or to submit feedback, please visit our Web site at: *http://science-education.nih.gov* or write to:

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We appreciate the valuable contributions of the talented staff at Biological Sciences Curriculum Study (BSCS) and Videodiscovery, Inc. We are also grateful to the NIH scientists, advisors, and all other participating professionals for their work and dedication. Finally, we thank the teachers and students who participated in focus groups and field tests to ensure that these supplements are both engaging and effective. I hope you find our series a valuable addition to your classroom and wish you a productive school year.

Bruce A. Fuchs, Ph.D.
Director
Office of Science Education
National Institutes of Health

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[1] The National Academy of Sciences released the *National Science Education Standards* in December 1995 outlining what all citizens should understand about science by the time they graduate from high school. The *Standards* encourages teachers to select major science concepts that empower students to use information to solve problems rather than stressing memorization of unrelated information.

About the National Institutes of Health

The National Institutes of Health (NIH), the world's top medical research center, is charged with addressing the health concerns of the nation. The NIH is the largest U.S. governmental sponsor of health studies conducted nationwide.

Simply described, the NIH's goal is to acquire new knowledge to help prevent, detect, diagnose, and treat disease and disability, from the rarest genetic disorder to the common cold. The NIH works toward that goal by conducting research in its own laboratories in Bethesda, Maryland and at several other locations throughout the United States; supporting the research of nonfederal scientists throughout the country and abroad; helping to train research investigators; and fostering communication of medical information to the public.

The NIH Supports Research

A principal concern of the NIH is to invest wisely the tax dollars entrusted to it for the support and conduct of medical research. Approximately 82 percent of the investment is made through grants and contracts supporting research and training in more than 2,000 universities, medical schools, hospitals, and research institutions throughout the United States and abroad.

Approximately 10 percent of the budget goes to more than 2,000 projects conducted mainly in NIH laboratories. About 80 percent covers support costs of research conducted both within and outside the NIH.

NIH Research Grants

To apply for a research grant, an individual scientist must submit an idea in a written application. Each application undergoes a peer review process. A panel of scientific experts, who are active researchers in the medical sciences, first evaluates the scientific merit of the application. Then, a national advisory council or board, composed of eminent scientists as well as members of the public who are interested in health issues or the medical sciences, determines the project's overall merit and priority. Because funds are limited, the process is very competitive.

The Nobelists

The rosters of those who have conducted research, or who have received NIH support over the years, include some of the world's most illustrious scientists and physicians. Among them are 101 scientists who have won Nobel Prizes for achievements as diverse as deciphering the genetic code and learning what causes hepatitis.

Five Nobelists made their prize-winning discoveries in NIH laboratories: Doctors Christian B. Anfinsen, Julius Axelrod, D. Carleton Gajdusek, Marshall W. Nirenberg, and Martin Rodbell.

Impact of the NIH on the Nation's Health

The research programs of the NIH have been remarkably successful during the past 50 years. NIH-funded scientists have made substantial progress in understanding the basic mechanisms of disease and have vastly improved the preventive, diagnostic, and therapeutic options available.

During the last few decades, NIH research played a major role in making possible achievements like these:

- Mortality from heart disease, the number one killer in the United States, dropped by 36 percent between 1977 and 1999.
- Improved treatments and detection methods increased the relative five-year survival rate for people with cancer to 60 percent.
- With effective medications and psychotherapy, the 19 million Americans who suffer from depression can now look forward to a better, more productive future.
- Vaccines protect against infectious diseases that once killed and disabled millions of children and adults.
- In 1990, NIH researchers performed the first trial of gene therapy in humans. Scientists are increasingly able to locate, identify, and describe the functions of many of the genes in the human genome. The ultimate goal is to develop screening tools and gene therapies for the general population for cancer and many other diseases.

Educational and Training Opportunities at the NIH

The NIH offers myriad opportunities including summer research positions for students. For details, visit *http://science-education.nih.gov/students.*

For more information about the NIH, visit *http://www.nih.gov.*

The NIH Office of Science Education

The NIH Office of Science Education (OSE) is bringing exciting new resources free of charge to science teachers of grades kindergarten through 12. OSE learning tools support teachers in training the next generation of scientists and scientifically literate citizens. These materials cover information not available in standard textbooks and allow students to explore biological concepts using real world examples. In addition to the curriculum supplements, OSE provides a host of valuable resources accessible through the OSE Web site (*http://science-education.nih.gov*), such as:

- **Snapshots of Science and Medicine**.[2] This online magazine—plus interactive learning tools—is designed for ease of use in high school science classrooms. Three issues, available for free, are published during the school year. Each focuses on a new area of research and includes four professionally written articles on findings, historical background, related ethical questions, and profiles of people working in the field. Also included are a teaching guide, classroom activities, handouts, and more. (*http://science-education.nih.gov/snapshots*)

- **Women Are Scientists Video and Poster Series**.[3] This series provides teachers and guidance counselors with free tools to encourage young women to pursue careers in the medical field. The informative, full-color video and poster sets focus on some of the careers in which women are currently underrepresented. Three video and poster sets are now available: *Women are Surgeons, Women are Pathologists*, and *Women are Researchers*. (*http://science-education.nih.gov/women*)

- **Internship Programs**. Visit the OSE Web site to obtain information on a variety of NIH programs open to teachers and students. (*http://science-education.nih.gov/students*)

- **National Science Teacher Conferences**. Thousands of copies of NIH materials are distributed to teachers for free at the OSE exhibit booth at conferences of the National Science Teachers Association and the National Association of Biology Teachers. OSE also offers teacher-training workshops at many conferences. (*http://science-education.nih.gov/exhibits*)

In the development of learning tools, OSE supports science education reform as outlined in the *National Science Education Standards* and related guidelines.

We welcome your comments about existing resources and suggestions about how we may best meet your needs. Feel free to send your comments to us at *http://science-education.nih.gov/feedback*.

[2,3] These projects are collaborative efforts between OSE and NIH Office of Research on Women's Health.

About the National Institute of Dental and Craniofacial Research

The National Institute of Dental and Craniofacial Research (NIDCR*) is one of the three oldest Institutes of the NIH and the nation's primary sponsor of oral health research. The legislation enacted by Congress in 1948 to establish NIDCR entrusted it with national leadership in dental research, the conduct and support of research and training, and the timely transfer of research findings and information.

The impetus for the creation of NIDCR was World War II with its devastating revelation that rampant tooth decay was compromising our military preparedness: close to 10 percent of Army recruits were rejected because of missing teeth. It was a shock that so little was known about the cause of oral diseases. Thus, the Institute's research initially focused on dental caries (tooth decay) and studies showing the effectiveness of fluoride in preventing this disease. The discovery of fluoride was soon complemented by research that showed that both tooth decay and periodontal (gum) diseases were bacterial infections that could be prevented by a combination of individual, community, and professional actions.

Now, half a century later, we are realizing the benefits of our Federal investment in oral health research. The achievements of NIDCR have transformed dental practice, saved billions in the cost of dental care, and improved the oral health of the nation. Despite the many advances in oral health research, there is still much work to be done. Today, NIDCR research is directed toward resolving a wide array of oral diseases and disorders and addressing disparities in oral health status that continue to exist in our nation.

In addition to supporting research projects at institutions throughout the United States and in foreign countries, the NIDCR supports training and career development, works with voluntary organizations and patient groups, sponsors activities such as conferences and workshops for health professionals, and supports health education and health promotion activities. NIDCR's own investigators conduct basic laboratory and clinical research at facilities located on the campus of the National Institutes of

Health. Examples of research areas include the molecular biology, biochemistry, structure, function, and development of bones, teeth, salivary glands and connective tissues; the role of viruses, bacteria, and yeast in disease; complex human genetic disorders; cancers of the head and neck; cause and treatment of acute and chronic pain; and the development of new methods to diagnose and treat disease using bioengineering approaches. For more information about NIDCR, visit our Web site at *http://www.nidcr.nih.gov*.

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*Originally named the National Institute of Dental Research, the Institute's name was changed in 1998.

Introduction to *Open Wide and Trek Inside*

What Are the Objectives of the Module?

Open Wide and Trek Inside has several objectives. The first is to help students understand major concepts related to oral health. By focusing on the science of the oral environment, the module goes beyond the traditional "brushing and flossing" curriculum and presents to students the ways science has helped people understand how to take proper care of their mouths and the structures within.

The second objective of the module is to engage students in the nature of science through inquiry. As students ask and answer questions about their mouths, they model the process scientists use to find out more about the natural world.

Science plays an important role in assisting individuals as they make choices about enhancing personal and public health. In this module, students see that science provides evidence that can be used to support ways of understanding and treating oral health and disease. Because the mission of the National Institute of Dental and Craniofacial Research is to improve and promote craniofacial, oral, and dental health, the Institute believes that education provides one context in which it can fulfill its mission. The lessons in this module encourage students to think about the relationships among knowledge, choice, behavior, and enhanced human health in this way:

knowledge (what is known and not known) + choice = power

power + behavior = enhanced human health

An additional objective of this module is to encourage students to think in terms of these relationships now and as they grow older, and to use their knowledge of the oral environment to affect positive behaviors that enhance their oral health.

Why Teach the Module?

Elementary school science offers the perfect opportunity to integrate many areas of student interest. In this module, students participate in activities that integrate inquiry science, language arts, human health, decision-making concepts, and mathematics. The personal context of the module's lessons is engaging for students, and the knowledge gained by participating in the module can be applied immediately to students' lives.

> *"My students are very aware of their own dental health now—they beg to brush their teeth every day after lunch!"*
> —Field-test Teacher

What's in It for the Teacher?

Open Wide and Trek Inside meets many of the criteria used to assess teachers and their programs.

- The module is **standards based** and meets science content, teaching, and assessment standards as expressed in the *National Science Education Standards*. It pays particular attention to the standards that describe what students should know and be able to do with respect to **scientific inquiry**.
- As described above, it is an **integrated** module, drawing most heavily from the subjects of science, language arts, mathematics, and health.
- The module has a computer-based **technology component** that uses a CD-ROM on which there are mini-documentaries, animations, and interactive activities.
- The module includes built-in **assessment** tools, indicated by an assessment icon in each lesson.
- Finally, the module contains student pages and take-home activities in Spanish for students and parents that are more fluent in Spanish than English.

In addition, the module provides a means for **professional development**. Teachers can engage in new and different teaching practices, like those described in this module, without completely overhauling their entire yearlong program. In *Designing Professional Development for Teachers of Science and Mathematics*[1], Susan Loucks-Horsley *et al.* write that replacement modules such as *Open Wide and Trek Inside* can serve that purpose and "offer a window through which teachers can get a glimpse of what new teaching strategies look like in action." By experiencing a short-term unit like this one, teachers can "change how they think about teaching and embrace new approaches that stimulate students to problem solve, reason, investigate, and construct their own meaning for the content." The use of a replacement unit like this can encourage reflection and discussion and stimulate teachers to improve their practices by focusing on student learning through inquiry.

> *"When we visited the dentist's office, he was amazed how much the children knew about their mouths and dental care. Thanks to this module, I look really good as a teacher!"*
>
> —Field-test Teacher

Implementing the Module

The six lessons in this module are designed to be taught either in sequence for two to three weeks or as individual lessons that support or enhance your treatment of specific concepts in science. Many field-test teachers felt that the topic of the module, oral health, is especially appropriate for science classes during the month of February, which is National Children's Dental Health Month.

The following pages offer general suggestions about using these materials in the classroom; you will find specific suggestions in the procedures provided for each lesson.

What Are the Goals of the Module?

Open Wide and Trek Inside is designed to help students develop the following major goals associated with scientific literacy:

- to understand a set of basic scientific principles related to oral health,
- to experience the process of scientific inquiry and develop an enhanced understanding of the nature and methods of science, and
- to recognize the role of science in society and the relationship between basic science and human health.

What Are the Science Concepts and How Are They Connected?

We have organized the lessons to form a conceptual whole that moves students from an introduction to mouth structures and their functions (*What Do Mouths Do?*) to thinking about the mouth as an environment (*Open Wide! What's Inside?*). When students begin asking questions about the teeth in the mouth, they use scientific inquiry to answer the questions (*Let's Investigate Tooth Decay!*). To help students explain how the results of their investigation relate to what happens in their mouths, students become aware of the actions of oral bacteria in the process of tooth decay (*What Lives Inside Your Mouth?*). Students use science concepts to help them understand how to keep their mouths healthy (*What Keeps Your Mouth Healthy?*). Finally, students reflect on what they have learned about the process of tooth decay and behaviors that keep their mouths healthy (*What Have You Learned About the Mouth?*). The following chart, *Conceptual Flow of the Lessons*, illustrates the sequence of major concepts addressed by the six lessons.

Conceptual Flow of the Lessons

Lesson	Learning Focus	Major Concept
Lesson 1 *What Do Mouths Do?*	Engage/Explore*: Students express prior knowledge, become engaged in the topic of oral health, and begin to explore their mouths.	The mouth, or oral cavity, serves many purposes and has many different parts.
Lesson 2 *Open Wide! What's Inside?*	Explore: Students explore the mouth as an environment made up of many structures. The Explore phase gives students a common set of experiences upon which to begin building conceptual understanding.	The mouth is an environment made up of many physical structures. Some are visible, others are not. Teeth are structures in the mouth and there are different types of teeth that serve different functions.
Lesson 3 *Let's Investigate Tooth Decay!*	Explore: Students continue to explore the mouth and use scientific inquiry to answer a question.	Scientific inquiry can help answer questions about the natural world. Scientists use models when they cannot investigate real things. An apple can be used as a model of a tooth to show the process of tooth decay.
Lesson 4 *What Lives Inside Your Mouth?*	Explain: Students use evidence from their apple investigation to explain in their own words the process of tooth decay. The teacher introduces the concept of living organisms in the mouth (oral bacteria) and students expand their ideas about tooth decay to include the actions of oral bacteria.	Oral bacteria live in the mouth. Bacteria behave like other living things: they take in nutrients, they reproduce, and they produce waste (an acid). Tooth decay is the result of the acid from the bacteria acting on the tooth surfaces.
Lesson 5 *What Keeps Your Mouth Healthy?*	Elaborate: Students apply the module's science concepts to their understanding of how to keep their mouths healthy.	The oral disease process depends on bacteria. Sugary and starchy foods create more bacteria and acid in the mouth. Eating healthy foods, removing plaque from teeth, and using fluorides and sealants can help maintain a healthy mouth and a healthy body.
Lesson 6 *What Have You Learned about the Mouth?*	Evaluate: Students demonstrate their understanding of concepts and performance of skills.	Certain steps in a normal day can increase or decrease the opportunity for bacteria to release acid and promote tooth decay. Understanding these steps can help a person maintain a healthy mouth.

*See *How Does the 5E Instructional Model Promote Active, Collaborative, Inquiry-based Learning?* on page 8.

How Does the Module Correlate with the *National Science Education Standards?*

Open Wide and Trek Inside supports teachers in their efforts to reform science education in the spirit of the National Research Council's 1996 *National Science Education Standards (NSES)*.[1] The content of the module is explicitly standards based: Each time a standard is addressed in a lesson, an icon appears in the margin and the applicable standard is identified. The chart, *Content Standards: Grades K–4*, lists the specific content standards that this module addresses.

Content Standards: Grades K–4

Standard A: As a result of activities in grades K–4, all students should develop abilities necessary to do scientific inquiry and understanding about scientific inquiry.	**Correlation to *Open Wide and Trek Inside***
• Ask a question about objects, organisms, and events in the environment.	Lessons 1, 2, 3
• Plan and conduct a simple investigation.	Lesson 3
• Employ simple equipment and tools to gather data and extend the senses.	Lessons 2 and 3
• Use data to construct a reasonable explanation.	Lessons 2 and 3
• Communicate investigations and explanations.	Lessons 1, 2, 3, 6
• Develop understandings about scientific inquiry.	Lesson 3
Standard C: As a result of their activities in grades K–4, all students should develop understanding of the characteristics of organisms.	
• Organisms have basic needs. For example, animals need air, water, and food. Organisms can survive only in environments in which their needs can be met.	Lesson 4
• Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking.	Lessons 1 and 2
• An organism's patterns of behavior are related to the nature of that environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.	Lessons 4 and 5
• All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.	Lessons 4, 5, 6
Standard F: As a result of their activities in grades K–4, all students should develop an understanding of personal health.	
• Individuals should have some responsibility for their own health. Students should engage in personal care—dental hygiene, cleanliness, and exercise—that will maintain and improve health.	Lessons 5 and 6
• Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat.	Lessons 5 and 6

Teaching Standards

The suggested teaching strategies in all the lessons support teachers as they work to meet the teaching standards outlined in the *National Science Education Standards*. The module helps teachers of science plan an inquiry-based science program by providing short-term objectives for students. It also includes planning tools such as the *Conceptual Flow of the Lessons* chart and the *Suggested Timeline* for teaching the module. Teachers can use this module to update their curriculum in response to their students' interest in this topic. The focus on active, collaborative, and inquiry-based learning in the lessons helps teachers support the development of student understanding and nurture a community of science learners.

The structure of the lessons in this module enables teachers to guide and facilitate learning. All the activities encourage and support student inquiry, promote discourse among students, and challenge students to accept and share responsibility for their learning. The use of the 5E Instructional Model, combined with active, collaborative learning, allows teachers to respond effectively to the diversity of student backgrounds and learning styles. The module is fully annotated, with suggestions for how teachers can encourage and model the skills of scientific inquiry, as well as the curiosity, openness to new ideas and data, and skepticism that characterize science.

Assessment Standards

Teachers can engage in ongoing assessment of both their teaching and student learning using the variety of assessment components embedded within the module's structure. The assessment tasks are authentic: They are similar in form to tasks in which students will engage in their lives outside the classroom or in which scientists participate. Annotations guide teachers to these opportunities for assessment and provide answers to questions that can help teachers analyze student feedback.

How Does the 5E Instructional Model Promote Active, Collaborative, Inquiry-based Learning?

Because learning does not occur through a process of passive absorption, the lessons in this module promote active learning: Students are involved in more than listening and reading. They are developing skills, analyzing and evaluating evidence, experiencing and discussing, and talking to their peers about their own understandings. Students work collaboratively with others to solve problems and plan investigations. Many students find that they learn better when they work with others in a collaborative environment than they can when they work alone in a competitive environment. When all this active, collaborative learning is directed toward inquiry science, students succeed in making their own discoveries. They ask questions, observe, analyze, explain, draw conclusions, and ask new questions. These inquiry experiences include both those that involve students in direct experimentation and those in which students develop explanations through critical and logical thinking.

This view of students as active thinkers who construct their own understanding out of interactions with phenomena, the environment, and other individuals is based on the theory of **constructivism**. A constructivist view of learning recognizes that students need time to

- express their current thinking;
- interact with objects, organisms, substances, and equipment to develop a range of experiences on which to base their thinking;
- reflect on their thinking by writing, drawing, and expressing themselves and comparing what they think with what others think; and
- make connections between their learning experiences and the real world.

This module provides a built-in structure for creating a constructivist classroom: The 5E Instructional Model. This model sequences the learning experiences so that students have the opportunity to construct their understanding of a concept over time. The model takes students through five phases of learning that are easily described using five words that begin with the letter "E": Engage, Explore, Explain, Elaborate, and Evaluate. The following paragraphs illustrate how the 5Es are implemented across the lessons in this module.

Engage

Students come to learning situations with prior knowledge. This knowledge may or may not be congruent with the concepts presented in this module. The Engage lesson provides the opportunity for teachers to find out what students already know or what they think they know about the topic and concepts to be developed.

The Engage lesson in this module, Lesson 1: *What Do Mouths Do?*, is designed to

- pique students' curiosity and generate interest,
- determine students' current understanding of the mouth and the structures inside,
- invite students to raise their own questions about the mouth,
- encourage students to compare their ideas with those of others, and
- allow teachers to assess what students do or do not understand about the stated outcomes of the lesson.

Explore

In the Explore phase of the module, students explore their mouths and the structures within their mouths, especially their teeth. Students use an apple as a model of a tooth to explore tooth decay. These lessons provide a common set of experiences within which students can compare how they think about what they are observing and experiencing.

During the Explore lessons in this module, Lesson 1: *What Do Mouths Do?*, Lesson 2: *Open Wide! What's Inside?*, and Lesson 3: *Let's Investigate Tooth Decay!*, students

- interact with materials and ideas as they explore their mouths and do the apple investigation;

- consider different ways to solve a problem or answer a question;
- acquire a common set of experiences with their classmates so they can compare results and ideas;
- observe, describe, record, compare, and share their ideas and experiences; and
- express their developing understanding of the environment of the mouth and the process of tooth decay.

Explain

The Explain lesson provides opportunities for students to connect their previous experiences and to begin to make conceptual sense of the main ideas of the module. This stage also allows for the introduction of formal language, scientific terms, and content information that might make students' previous experiences easier to describe and explain.

In the Explain lesson in this module, Lesson 4: *What Lives Inside Your Mouth?*, students

- explain concepts and ideas about tooth decay in their own words;
- listen to and compare others' explanations of their results with their own;
- become involved in student-to-student discourse in which they explain their thinking to others and debate their ideas;
- revise their ideas;
- record their ideas and current understanding;
- use labels, terminology, and formal language to describe the process of tooth decay in the presence of bacteria;
- compare their current thinking with what they previously thought; and
- compare their ideas with what scientists know and understand about oral health and the process of tooth decay.

Elaborate

In the Elaborate lesson, students apply or extend the concepts in new situations and relate their previous experiences to new ones.

In the Elaborate lesson in this module, Lesson 5: *What Keeps Your Mouth Healthy?*, students

- make conceptual connections between new and former experiences, particularly with respect to how they care for their mouths and teeth;
- use what they have learned to explain why dental health professionals promote brushing with fluoride toothpaste and avoiding sugary foods;
- connect ideas, solve problems, and apply their understanding to their own lives;
- use scientific terms and descriptions;
- draw reasonable conclusions from evidence and data;
- add depth to their understanding of concepts and processes; and
- communicate their understanding to others.

Evaluate

The Evaluate lesson is the final stage of the instructional model, but it only provides a "snapshot" of what the students understand and how far they have come from where they began. In reality, the evaluation of students' conceptual understanding and ability to use skills begins with the Engage lesson and continues throughout each stage of the model, as described in the following section. Combined with the students' written work, drawings, and performance of tasks throughout the module, the Evaluate lesson can serve as a summative assessment of what students know and can do.

The Evaluate lesson in this module, Lesson 6: *What Have You Learned about the Mouth?*, provides opportunities for students to

- demonstrate what they understand about the concepts of oral health as they sequence pictures;
- share their current thinking with others;
- apply their understanding and knowledge of the relationship among bacteria, the foods they eat, and their oral hygiene in a unique, but related, situation;
- assess their own progress by comparing their current understanding with their prior knowledge; and
- ask new questions that take them deeper into a concept or topic area.

To review the relationship of the 5E instructional model to the concepts presented in the module, see the chart, *Conceptual Flow of the Lessons*, on page 6.

When a teacher uses the 5E instructional model, he or she engages in practices that are very different from those of a traditional teacher. In response, students also participate in their learning in ways that are different from those seen in a traditional classroom. The charts, *What the Teacher Does* and *What the Students Do*, on pages 12 and 13 outline these differences.

How Does the Module Support Ongoing Assessment?

Because teachers will use this module in a variety of ways and at a variety of points in their curriculum, the most appropriate mechanism for assessing student learning is one that occurs informally at various points within the six lessons, rather than something that happens more formally just once at the end of the module. Accordingly, integrated within the six lessons in the module are specific assessment components. These "embedded" assessment opportunities include one or more of the following strategies:

- performance-based activities (for example, developing graphs or making lists);
- oral presentations to the class (for example, presenting experimental results); and
- written assignments (for example, answering questions or writing and drawing in journals).

What the Teacher Does

Stage of the Instructional Model	That Is *Consistent* with the 5E Instructional Model	That Is *Inconsistent* with the 5E Instructional Model
Engage	• Piques students' curiosity and generates interest • Determines students' current understanding (prior knowledge) of a concept or idea • Invites students to express what they think • Invites students to raise their own questions	• Introduces vocabulary • Explains concepts • Provides definitions and answers • Provides closure • Discourages students' ideas and questions
Explore	• Encourages student-to-student interaction • Observes and listens to the students as they interact • Asks probing questions to redirect the students' investigations when necessary • Asks questions to help students make sense of their experiences • Provides time for students to puzzle through problems	• Provides answers • Proceeds too rapidly for students to make sense of their experiences • Provides closure • Tells the students that they are wrong • Gives information and facts that solve the problem • Leads the students step-by-step to a solution
Explain	• Encourages students to use their common experiences and data from the Engage and Explore lessons to develop explanations • Asks questions that help students express understanding and explanations • Requests justification (evidence) for students' explanations • Provides time for students to compare their ideas with those of others and perhaps to revise their thinking • Introduces terminology and alternative explanations after students express their ideas	• Neglects to solicit students' explanations • Ignores data and information students gathered from previous lessons • Dismisses students' ideas • Accepts explanations that are not supported by evidence • Introduces unrelated concepts or skills
Elaborate	• Focuses students' attention on conceptual connections between new and former experiences • Encourages students to use what they have learned to explain a new event or idea • Reinforces students' use of scientific terms and descriptions previously introduced • Asks questions that help students draw reasonable conclusions from evidence and data	• Neglects to help students connect new and former experiences • Provides definitive answers • Tells the students that they are wrong • Leads students step-by-step to a solution
Evaluate	• Observes and records as students demonstrate their understanding of concept(s) and performance of skills • Provides time for students to compare their ideas with those of others and perhaps to revise their thinking • Interviews students as a means of assessing their developing understanding • Encourages students to assess their own progress	• Tests vocabulary words, terms, and isolated facts • Introduces new ideas or concepts • Creates ambiguity • Promotes open-ended discussion unrelated to the concept or skill

What the Students Do

Stage of the Instructional Model	That Is *Consistent* with the 5E Instructional Model	That Is *Inconsistent* with the 5E Instructional Model
Engage	• Become interested in and curious about the concept/topic • Express current understanding of a concept or idea • Raise questions such as, What do I already know about this? What do I want to know about this? How could I find out?	• Ask for the "right" answer • Offer the "right" answer • Insist on answers or explanations • Seek closure
Explore	• "Mess around" with materials and ideas • Conduct investigations in which they observe, describe, and record data • Try different ways to solve a problem or answer a question • Acquire a common set of experiences so they can compare results and ideas • Compare their ideas with those of others	• Let others do the thinking and exploring (passive involvement) • Work quietly with little or no interaction with others (only appropriate when exploring ideas or feelings) • Stop with one solution • Demand or seek closure
Explain	• Explain concepts and ideas in their own words • Base their explanations on evidence acquired during previous investigations • Become involved in student-to-student conversations in which they debate their ideas • Record their ideas and current understanding • Reflect on and perhaps revise their ideas • Express their ideas using appropriate scientific language • Compare their ideas with what scientists know and understand	• Propose explanations from "thin air" with no relationship to previous experiences • Bring up irrelevant experiences and examples • Accept explanations without justification • Ignore or dismiss other plausible explanations • Propose explanations without evidence to support their ideas
Elaborate	• Make conceptual connections between new and former experiences • Use what they have learned to explain a new object, event, organism, or idea • Use scientific terms and descriptions • Draw reasonable conclusions from evidence and data • Communicate their understanding to others	• Ignore previous information or evidence • Draw conclusions from "thin air" • Use terminology inappropriately and without understanding
Evaluate	• Demonstrate what they understand about the concept(s) and how well they can implement a skill • Compare their current thinking with that of others and perhaps revise their ideas • Assess their own progress by comparing their current understanding with their prior knowledge • Ask new questions that take them deeper into a concept or topic area	• Disregard evidence or previously accepted explanations in drawing conclusions • Offer only yes-or-no answers or memorized definitions or explanations as answers • Fail to express satisfactory explanations in their own words • Introduce new, irrelevant topics

These strategies allow the teacher to assess a variety of aspects of the learning process, such as students' prior knowledge and current understanding, problem-solving and critical-thinking skills, level of understanding of new information, communication skills, and ability to synthesize ideas and apply understanding to a new situation.

☑ An assessment icon and an annotation that describes the aspect of learning that teachers can assess appear in the margin beside the step in which each embedded assessment occurs.

How Can Teachers Promote Safety in the Science Classroom?

Even simple science demonstrations and investigations can be hazardous unless teachers and students know and follow safety precautions. Teachers are responsible for providing students with active instruction concerning their conduct and safety in the classroom: Posting rules in a classroom is not enough. They also need to provide adequate supervision and advance warning if there are dangers involved in the science investigation. By maintaining equipment in proper working order, teachers ensure a safe environment for students.

The following are important ways to implement and maintain a safety program.

- Provide eye protection for students, teachers, and visitors. Require that everyone participating wear regulation goggles in any situation where there might be splashes, spills, or spattering. Teachers should always wear goggles in such situations.
- Know and follow the state and district safety rules and policies. Be sure to fully explain to the students the safety rules they should use in the classroom.
- At the beginning of the school year, establish consequences for students who behave in an unsafe manner. Make these consequences clear to students.
- Do not overlook any violation of a safety practice, no matter how minor. If a rule is broken, take steps to ensure that the infraction will not occur a second time.
- Set a good example by observing all safety practices. This includes wearing eye protection during all investigations when eye protection is required for the students.
- Know and follow waste disposal regulations.
- Be aware of students who have allergies or other medical conditions that might limit their ability to participate in activities. Consult with the school nurse or school administrator.
- Anticipate potential problems. When planning teacher demonstrations or student investigations, identify potential hazards and safety concerns. Be aware of what might go wrong and what can be done to prevent the worst-case scenario. Before each activity, alert the students to the potential hazards verbally and distribute specific safety instructions as well.

- Supervise students at all times during a hands-on activity.
- Provide sufficient time for students to set up the equipment, perform the investigation, and properly clean up and store the materials after use.
- Never assume that students know or remember safety rules or practices from their previous science classes.

How Can Controversial Topics Be Handled in the Classroom?

Teachers sometimes feel that the discussion of values is inappropriate in the science classroom or that it detracts from the learning of "real" science. The lessons in this module, however, are based upon the conviction that there is much to be gained by involving students in analyzing issues of science, technology, and society. Society expects all citizens to participate in the democratic process, and our educational system must provide opportunities for students to learn to deal with contentious issues with civility, objectivity, and fairness. Likewise, students need to learn that science intersects with life in many ways.

In this module, students have a variety of opportunities to discuss, interpret, and evaluate basic science and health issues, some in the light of values and ethics. As students encounter issues about which they feel strongly, some discussions might become controversial. How much controversy develops will depend on many factors, such as how similar the students are with respect to socioeconomic status, perspectives, value systems, and religious preferences. In addition, the language and attitude of the teacher factor into the flow of ideas and the quality of exchange among the students.

The following guidelines may help teachers facilitate discussions that balance factual information with feelings.

- Remain neutral. Neutrality may be the single most important characteristic of a successful discussion facilitator.
- Encourage students to discover as much information about the issue as possible.
- Keep the discussion relevant and moving forward by questioning or posing appropriate problems or hypothetical situations. Encourage everyone to contribute, but do not force reluctant students into the discussion.
- Emphasize that everyone must be open to hearing and considering diverse views.
- Use unbiased questioning to help the students critically examine all views presented.
- Allow for the discussion of all feelings and opinions.
- Avoid seeking consensus on all issues. The multifaceted issues that the students discuss result in the presentation of divergent views, and students should learn that this is acceptable.

- Acknowledge all contributions in the same evenhanded manner. If a student seems to be saying something for its shock value, see whether other students recognize the inappropriate comment and invite them to respond.
- Create a sense of freedom in the classroom. Remind students, however, that freedom implies the responsibility to exercise that freedom in ways that generate positive results for all.
- Insist upon a nonhostile environment in the classroom. Remind students to respond to ideas instead of to the individuals presenting them.
- Respect silence. Reflective discussions often are slow. If a teacher breaks the silence, students may allow the teacher to dominate the discussion.
- At the end of the discussion, ask the students to summarize the points that they and their classmates have made. Respect students regardless of their opinion about any controversial issue.

Using the CD-ROM

The CD-ROM component of *Open Wide and Trek Inside* is a tool, like an overhead projector or a textbook, that can help you organize your use of the module, engage student interest in learning, and orchestrate and individualize instruction. The CD-ROM contains the following major resources:

- introduction to the National Institutes of Health;
- video clips, animations, and interactive games required to teach various activities within the lessons;
- supplemental animations that can enhance students' understanding of concepts presented in the print material; and
- printable files of this module.

Installation Instructions

The CD-ROM runs on Apple Macintosh and IBM-compatible personal computers. The minimum requirements for a Macintosh computer are the following: OS 8.5 operating system or higher, Power PC processor, 256-color monitor or higher, 32 megabytes RAM, QuickTime 4 or 5 for Macintosh, and a 2x CD-ROM drive. Mac users can download QuickTime from Apple Computers at *http://www.apple.com/quicktime/download/*.

The minimum requirements for IBM-compatible computers are the following: Windows 95 operating system or higher, Pentium 100 processor or higher, 256-color monitor or higher, 32 megabytes RAM, Soundblaster or Windows Sound System-compatible card, Windows Media Player, QuickTime 4 or higher, and a 2x CD-ROM drive. Windows users can download the latest version of Media Player from Microsoft at *http://www.microsoft.com/windows/windowsmedia/en/Download/default.asp*. PC users can download QuickTime from Apple Computers at *http://www.apple.com/quicktime/download/*.

To use the CD-ROM, load it into the CD-ROM drive as you would any other CD. Then, follow the installation instructions shown in the chart on page 18.

Loading Instructions for the *Open Wide and Trek Inside* CD-ROM

IBM-Compatible Computers
Place the CD in the CD-ROM drive and close the door. The CD should automatically launch the program.

If you have turned off the autorun feature on your CD-ROM drive or if you want to run the software without ejecting and re-inserting the disk each time you use the program, do one of the following:

- Click Start / Run and type the following in the dialog box: d:\nidcr.exe (change "d:\" if necessary). Click OK.

Macintosh Computers
Place the CD in the CD-ROM drive and close the door.

Open the CD-ROM, then click on the NIH icon.

Network Installation
A network installation of the entire program requires up to 450 to 650 megabytes of disk space. Performance of the videos will depend on the network speed and the processor speed of client stations. Each client computer must have QuickTime 5 or higher installed.

1. Place the disk in the CD-ROM drive and click on Quit if program opens automatically.
2. Create a folder on the network or local drive where you want to install the application and name it *Open Wide*.
3. Copy all the folders and files in the root directory of the CD-ROM into the new folder. Note: Macintosh users cannot see files from the PC format on the CD-ROM and vice versa. If you run both platforms from your network, you will need to copy files from the CD to the network twice, once from a network PC and once from a network Mac. If you have room, create two complete copies of the software in different folders, one for each platform. Because users will see both Mac and PC files on the network, be sure that Mac users open only the Mac files and PC users open only the PC files.
4. To run the application, follow the procedures described here for IBM-compatible or Macintosh computers by locating the local or network copy of the desired program files.

Note: If you have trouble running the CD-ROM, please make sure you have the correct plug-ins loaded on your computer(s). For more information, please consult the Readme file on the CD-ROM.

Getting the Most out of the CD-ROM

Before you use this CD-ROM or any other piece of instructional software in your classroom, it may be valuable to identify some of the benefits you expect software to provide. Well-designed multimedia software can

- motivate students by helping them enjoy learning and want to learn more because it enlivens content that students might otherwise find dull and uninteresting;
- offer unique instructional capabilities that allow students to explore topics in greater depth and in ways that are closer to actual field experiences than print-based resources can offer;
- provide teachers with support for experimenting with new instructional approaches that allow students to work independently or in small teams and that give teachers increased credibility among today's technology-literate students; and

- increase teacher productivity by helping teachers with assessment, record keeping, and classroom planning and management; this module offers teachers the convenience of several weeks of instruction stored in the space of a single CD and this teacher's guide.

The ideal use of the CD-ROM requires one computer for each student team; the installation instructions explain how to make the information available over a network. However, if you have only one computer and CD-ROM drive available, you still can use the CD (for example, by using a suitable display device to show animations or videos to the whole class or by rotating teams through a computer station to access CD-ROM-based resources). If you do not have the facilities for using the CD-ROM in your classroom, a print-based alternative for each activity that requires the CD is included in this module.

Collaborative Groups

Many of the activities in this module are designed to be completed by groups of students working together. Although individual students working alone can complete many of the specific steps, this strategy will not stimulate the type of student-student interaction that is one of the goals of active, collaborative, inquiry-based learning. Therefore, we recommend that you organize collaborative groups of two or three students, depending on the number of computers equipped with CD-ROM drives you have available. If necessary, up to six students may work as a group, although the students may not be as involved in the activity. Students in groups larger than this will have difficulty organizing the student-computer interactions equitably, which can lead to one or two students assuming the primary responsibility for the computer-based work. Although this type of arrangement can be efficient, it means that some students do not get the opportunity to experience the in-depth discovery and analysis that the enclosed CD-ROM was designed to stimulate.

If you are teaching all six lessons as a unit, we recommend that you keep your students in the same collaborative groups for all of the activities in the lessons. This will allow each group to develop a shared experience with the software and with the ideas and issues that the activities present. A shared experience also will enhance your students' perceptions of the lessons as a conceptual whole.

If your student-to-computer ratio is greater than six students to one computer, you will need to change the way you teach the module from the instructions in the lessons. For example, if you have only one computer available, you may want students to complete the CD-based work across an extended period. You can do this in several ways. The most practical way is to use your computer as a center along with several other centers at which students complete other activities. In this strategy, students would rotate through the computer center, eventually completing the CD-based work that you have assigned.

A second way to structure the lessons if you have only one computer available is to use a projection system to display the computer monitor onto a screen for the whole class to see simultaneously. Giving selected students in the class the opportunity to manipulate the program in response to class suggestions and requests can give students some of the same type of autonomy in their learning that they would gain if they were working with the CD in small teams.

Using the Student Lessons

The heart of this module is the set of six lessons that follows. These lessons are the vehicles that we hope will carry important concepts related to oral health to your students. To review the concepts in detail, refer to the chart, *Conceptual Flow of the Lessons*, on page 6.

Format of the Lessons

As you scan the lessons, you will find that each contains several major features.

At a Glance gives the teacher a convenient overview of the lesson.

- The **Overview** provides a short summary of student activities.
- **Purpose** states the central idea(s) the lesson is designed to convey.
- **Objectives** lists two to six specific understandings or abilities students should have after completing the lesson.

Background Information provides the teacher with the science content that underlies the key concepts of the lessons. The information provided here is designed to enhance the teacher's understanding of the content so that the teacher can more accurately facilitate class discussions, answer student questions, and provide additional examples.

In Advance provides instructions for collecting and preparing the materials required to complete the activities in the lesson.

- **CD-ROM Activities** tells the teacher which of the lesson's activities make use of segments on the CD-ROM.
- **Photocopies** lists the paper copies or transparencies that need to be made from masters, which follow the student lessons.
- **Materials** lists all the materials needed for each of the activities in the lesson. A complete materials list for the entire module can be found on page 24–25.
- **Preparation** outlines the things the teacher needs to do to be ready to teach each of the activities in the lesson.

Procedure outlines the steps in each activity in the lesson. It provides implementation suggestions and answers to questions. **Wrap-up** offers suggestions for using the *Mouth Journals* as opportunities for assessment. Lesson 2 has **Extension Activities** that enrich the students' experience with the module through additional games.

Within the procedures, annotations provide additional commentary.

- **Tip from the field test** includes actual field-test teachers' suggestions for teaching strategies, class management, and module implementation.
- **Assessment** provides the teacher with strategies for assessing student progress throughout the module, and is identified by an assessment icon (see the following section).
- **Icons** identify specific annotations:

NSES identifies teaching strategies that address specific science content standards as defined by the *National Science Education Standards.*

◉ identifies when to use the CD-ROM as part of the teaching strategies. An annotation instructs the teacher how to find the appropriate segment on the CD-ROM. Information about using the CD can be found in *Using the CD-ROM.* A print-based alternative is provided in each lesson for all CD-ROM activities in case a computer with a CD-ROM drive is not available.

✓ identifies when assessment is embedded in the module's structure. An annotation suggests strategies for assessment.

There are three **Take-home Activities** included in the module as part of Lessons 2, 3, and 5. These activities are designed to engage children and their parents in oral health concepts at home. The handouts for the take-home activities are located in the Masters section at the end of the module. A certificate at the end of each handout provides evidence for the teacher of parent-child interaction.

> *"The most gratifying part for me has been the POSITIVE feedback from parents as well as from the kids…we have just finished conferences and almost every parent commented that their child has come home and told them daily what we are doing and learning. Some families still have the egg experiment from one of the take-home activities going on their own!"*
>
> —Field-test Teacher

The **Masters** required to teach the lessons are located in a separate section at the end of the module.

Timeline for Teaching the Module

The *Open Wide and Trek Inside* module is designed to be taught every day for a period of approximately three weeks. Field-test teachers found that if they scheduled science lessons every day while they were teaching the module, students remained engaged and their understanding of the concepts that link the activities together steadily grew.

Suggested Timeline

Timeline	Activity
3 weeks ahead	Reserve computers • Check CD-ROM performance
1 week ahead	Copy masters • Make transparencies • Gather materials
Day 1	**Lesson 1** Activity 1: Helping Exee (the Extraterrestrial) Learn about Mouths
Day 2	Activity 2: Mouth Mirrors
Day 3	Activity 3: Food for Thought Wrap-up
Day 4	**Lesson 2** Activity 1: Mouth Trek
Day 5	Activity 2: Cut, Tear, and Grind
Day 6	Complete Activity 2 Take-home Activity • Tooth Record
Day 7	Activity 3: Graphing and Record Keeping
Day 8 (optional)	Extension Activities (optional) • Funny ABCs • Matching Game Wrap-up
Day 9	**Lesson 3** Activity 1: The Apple Investigation Take-home Activity • So You Want to Be an Eggs-pert Scientist! Wrap-up
Day 10	**Lesson 4** Activity 1: What Lives in Warm, Wet Places?
Day 11	Activity 2: Animals Do More than Eat and Drink
Day 12	Complete Activity 2 Wrap-up
Day 13	**Lesson 5** Activity 1: Let's Pretend—A Dramatization
Day 14	Wrap-up Take-home Activity • Brushing to the Beat!
Day 15	**Lesson 3** Activity 2: Completing the Apple Investigation Wrap-up (for Lesson 3)
Day 16	**Lesson 6** Activity 1: Exee Goes Home Wrap-up

The timeline on page 23 outlines the optimal plan for completing the six lessons in this module. The plan assumes you will teach the activities on consecutive days, spending approximately 20 to 30 minutes on science activities each day. If your class requires more time for laboratory procedures, discussion of ideas raised in this module, or completing activities on the CD-ROM, adjust your timeline accordingly.

Master List of Materials

The following is a complete list of supplies needed for this module. Quantities are based on a class of 30 students.

Lesson Number	1			2						3			4		5			6
Activity Number	1	2	3	1	2	*TH	3	†E1	†E2	1	2	*TH	1	2	1	2	*TH	1
Supply Description																		
Apple (preferably Red Delicious)									10	✓								
Assorted materials for student investigations (see Lesson)									✓	✓								
Balance (simple)									✓	✓								
Bicycle helmet or umbrella															✓			
Black construction paper															1			
CD-ROM and computers	✓				✓		✓		✓					✓	✓	✓		✓
Construction paper (any color)															2			60
Crayons or markers (non-toxic)	✓	✓	✓	✓			✓			✓	✓		✓					✓
Crackers			60		30													
Drawing paper													30					
Egg												✓						
Flip chart paper	✓	✓	✓	✓			✓			✓	✓							
Glue									✓						✓			✓
Hand lens										10	10							
Magazines (old with pictures of food)															✓			
Mouth Journal			✓						✓		✓			✓		✓		✓
Mirror (small)	✓																	
Napkin			30															
Overhead projector	✓		✓															
Pads of sticky notes (any color)															✓			

Master List of Materials (continued)

Lesson Number	1			2						3			4		5			6
Activity Number	1	2	3	1	2	*TH	3	†E1	†E2	1	2	*TH	1	2	1	2	*TH	1
Supply Description																		
Pencil (sharpened)																		
Plastic cup																		
Plastic wrap																		
Popsicle stick																		
Scissors																		
Sharp knife																		
Skein of red yarn																		
Small whiskbroom with handle																		
Thermometers																		
Thick paper or card stock																		
Tissues or paper towels																		
Transparencies																		
White construction paper																		
White vinegar																		

*TH: Take-Home Activity
†E1, E2: Extension Activities

Lesson 1
Engage/Explore

What Do Mouths Do?

AT A GLANCE
Overview

Lesson 1 engages the students in oral health by introducing a visitor: Exee from planet Y. Exee does not have a mouth and asks students what purpose their mouth serves. After students list everything their mouth helps them do, they sort the functions according to those that help them eat, drink, and communicate. Next, students play the game, *Mouth Mirrors*, in which they mimic the mouth movements of a partner. Through this game, students identify some of the structures of their oral cavity. Next, they eat a cracker and pay attention to how their mouth helps them eat. They connect the structures with the functions of the oral cavity. At the end of the lesson, students begin a *Mouth Journal* in which they answer the question, What would you tell Exee about the mouth?

Purpose

In this lesson, students will

- become engaged in learning about the mouth (oral cavity) and oral health and
- recognize that our mouth serves many purposes and has different parts.

Objectives

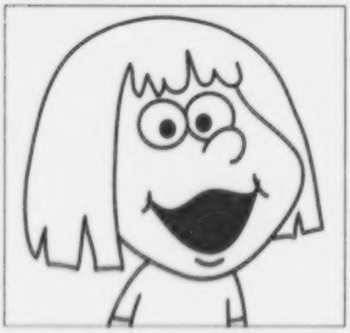
After completing this lesson, students will

- realize that the human mouth performs many functions that help a person eat, drink, and communicate (including speech and facial expressions);
- name functions of the mouth that help a person eat, such as bite, chew, taste, and swallow;
- describe functions of the mouth that help a person drink, such as open, close, taste, and swallow;

- identify functions of the mouth that help a person communicate, such as speak, shout, whisper, smile, pout, laugh, cry, sing, kiss, and whistle;
- indicate the structures in the mouth that help them perform these functions; and
- recognize that the tongue is the sensory organ of taste.

BACKGROUND INFORMATION

Our new friend, Exee, the extraterrestrial who zooms in from planet Y, asks a provocative question: Why do people have that hole (the mouth or the oral cavity) in the center of their faces?



The mouth is but one of the many sensory organs found in the craniofacial area. This area of our bodies houses the eyes, the ears, the nose, and the tongue—most of our sensory organs other than the skin.

Besides helping us taste food, the mouth performs many functions in basic survival and in other aspects of our lives. Our mouth allows us to take in essential nutrients and water and to communicate, both through speech and facial expressions. All of these functions are essential to life, as we know it.

Eating and Drinking

We must eat food and drink liquids to survive. To ingest food or liquid, our mouth must function correctly. The mouth is designed to take in this food and liquid and begin the digestion process.

Food must be broken down enough so that we can swallow it without choking or getting the food caught in the throat. How does the mouth do this?

- First, we place small, chewable amounts of food into the mouth either with our fingers or by using silverware.
- Then, our lips help by closing the area so that the food stays within the mouth.

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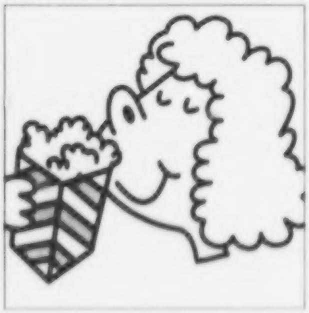
- After food has entered the oral cavity, the first of two stages of digestion occurs. First, the tongue moves the food around to various teeth so that the teeth can break the food into small pieces. The next stage occurs as the tongue, with the help of our saliva, transports the ball or mass of food, called a **bolus**, to the back of the mouth. (Note that saliva begins the digestion process within the oral cavity as it mixes certain enzymes with the food to help break down the food into the materials our bodies can use.)
- Then, we swallow the bolus at the pharynx so that the food can reach our stomach via the esophagus to continue the digestive process.

During the ingestion of liquids, the jaw and tongue help pass the liquid to the back of the mouth where we can swallow it.[1]

Taste and Smell

Another function of the mouth is to enable us to savor the food we eat. We enjoy food more when we can distinguish the flavor of the food as well as enjoy its texture. We can taste because we have taste buds that line the surface and sides of the tongue. We can smell thanks to specialized nervous tissue found at the top of the nasal cavities. We have "common chemical sense" because of the many nerve endings in the linings of the mouth and nose. A number of pathways take the information from these sensory areas to the brain. To fully enjoy the flavor of a food, all three of these senses need to be engaged.



Facial Expressions

Facial expressions can set the mood in many situations and usually tell us what people are thinking or feeling. For example, if we walk toward someone with a smile on our face, we are much more inviting than if we wear an expression of a scowl and pursed lips. Without a mouth and its structures, we would not be able to display our emotions through our expressions.

Our lips, teeth, jaws, cheeks, and facial muscles all play an important role in creating facial expressions. We are able to make facial expressions because of the complex muscular structure of the face. We have 22 muscles on either side of the face; humans have more facial muscles than any other animal.

Photo: Corel

All of our facial muscles are controlled by the facial nerve

Did You Know?
Approximately three-fourths of the flavor we experience from food actually comes from the aroma or smell of the food—from our olfactory system. The rest of the flavor we experience depends on taste (whether we sense the food as sweet, sour, bitter, or salty); the texture of the food; and whether we experience irritation, such as spiciness, from the food.[2]

Did You Know?
Among human expressions, the smile is the most recognized. According to research in this area, only smiles and surprise are identifiable in faces exposed briefly at 150 feet from the observer, and only smiles are identifiable at 300 feet.[3]

(cranial nerve VII). This nerve originates in the brain and divides into three branches to control the facial muscles. The first branch of the facial nerve allows our eyes to tear and our mouths to salivate. The second branch sends taste sensations to the brain, and the third directs facial expressions such as smiling, frowning, and squinting.[4] In addition, "Human facial skin is mobile and able to shape quickly according to pulses from the brain."[4] So, thanks to the nerves and muscles of our face, we can express ourselves very well without using any words at all.

Speech

We can form words to speak to one another because of the structure and tissues in our mouth. Our vocal cords and our respiratory system help produce the sounds we call speech. Probably the most important organ in speech formation is a muscle we often take for granted: our tongue. As stated by a speech pathologist,

> It could be the most unique muscle in the human body. Much of the time, it just sits still. But, at appropriate moments, the human tongue twists and turns and gyrates, and then, through subtle and exact movements, forms words and says what has to be said. A minute later and with entirely different motions, the muscular tongue can initiate a swallow that will permit its owner to eat and live.[5]

Human tongues, along with their associated nerves, the respiratory system, and the teeth and lips, are much more versatile than those of other animals, allowing humans the ability to speak unlike any other species on Earth.

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	yes
Activity 2	no
Activity 3	no

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Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	Master 1.1, *A Visitor from Outer Space*	1 copy for each student to color (optional) 1 transparency (optional)
Activity 2	none	none
Activity 3	none	none
Wrap-up	Master 1.2 *Mouth Journal* Master 1.3 *Mouth Journal Writing Pages*	1 copy for each student 6 copies for each student

Materials

Activity 1

For the class:

- CD-ROM
- computers
- overhead projector (optional)
- transparency of Master 1.1, *A Visitor from Outer Space* (optional)
- 1 sheet of flip chart paper
- markers

For each student:

1 copy of Master 1.1, *A Visitor from Outer Space* (optional)

Activity 2

For the class:

- list on flip chart paper, *What My Mouth Can Do*, from Activity 1
- 1 small mirror
- 1 sheet of flip chart paper
- markers

Activity 3

For the class:

- 1 sheet of flip chart paper
- markers

For each student:

- 2 crackers, such as saltines
- 1 napkin

Wrap-up Activity

For each student:

1 copy of Master 1.2, *Mouth Journal*
6 copies of Master 1.3, *Mouth Journal Writing Pages*

Preparation

- Arrange for students to have access to computers.
- Check students' health records for food allergies and make sure that all students can eat the crackers you bring to class. If students cannot eat saltines, provide an alternate snack, such as graham crackers or animal crackers that the entire class can eat.
- Gather the materials needed for the activities.
- Make a transparency of Master 1.1, *A Visitor from Outer Space* (optional).
- Duplicate Master 1.1, *A Visitor from Outer Space*, 1 for each student (optional).

- Decide whether you or your students will assemble the *Mouth Journals* from Master 1.2 and Master 1.3. Prepare accordingly. Students will write in their *Mouth Journal* at the end of each of the six lessons.

PROCEDURE

Activity 1: Helping Exee (the Extraterrestrial) Learn about Mouths

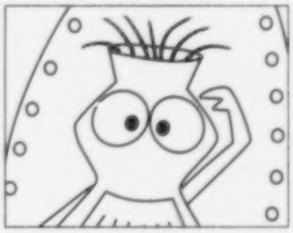
The purpose of this activity is to engage students in learning about their mouths.

Content Standard A: Abilities necessary to do scientific inquiry.

1. **Ask students to view the opening story on the CD-ROM. Discuss the story of Exee as necessary. Ask students to tell you what question Exee wants to answer.**

   Load the CD-ROM on the computer (see instructions for using the CD-ROM on pages 17-18). The opening story plays automatically when the CD-ROM starts. You can play the animation again by clicking on Exee Movie.

   Alternatively, you can gather the students in a whole group area and read the opening story from the transparency of Master 1.1, *A Visitor from Outer Space.*

   Tip from the field test: Make individual copies of Master 1.1, *A Visitor from Outer Space,* so that students can use them as coloring books. Showing overhead transparencies of the pictures from the master can help with the discussion of the Exee story.

If you would like to use this activity as a preassessment of what students know about their mouths, ask them to first complete the task individually. Then, make the class chart from the individual responses.

2. **Invite students to make a list for Exee explaining why they have mouths. Exactly what do their mouths do? Ask them to demonstrate and then name the action. Record the students' responses on a sheet of flip chart paper titled *What My Mouth Can Do.* (See sample chart on page 33).**

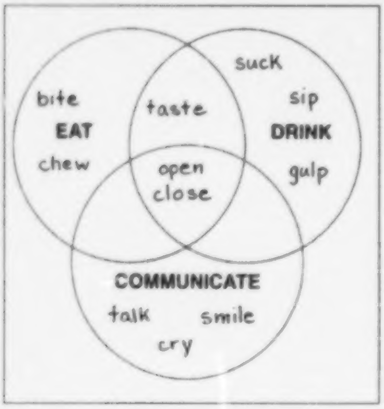
   Encourage the students to think of as many things as they can. They might include actions such as those listed on the sample chart, *What My Mouth Can Do.*

3. **Review the functions of the mouth by asking students to group the actions according to those that help a person**

   - **eat (for example, bite, chew, lick, taste, and swallow);**
   - **drink (for example, open, close, taste, and swallow); and**
   - **communicate (for example, talk, shout, whisper, smile, pout, laugh, cry, sing, kiss, and whistle).**

What My Mouth Can Do

open
laugh
cry
sing
whistle
drool
kiss
smile
pout
suck
yawn
close
eat
drink
chew
bite
lick
taste
talk
spit
shout
play a musical instrument
blow up a balloon
blow a bubble with gum
blow soap bubbles
chatter teeth when shivering



You might help students make a Venn diagram that organizes the different functions, as illustrated in the sample Venn Diagram.

Optional grouping activities include the following:

- Use hula hoops or circles of rope to make a physical Venn diagram. Write each function (open, bite, chew, and so on) on a separate index card and have students place each card in the appropriate place within the Venn diagram.
- Write each function on a separate index card and attach string or yarn to the cards. Give each student a card to wear around his or her neck and ask the students to place themselves in the appropriate places within the Venn diagram.

Tip from the field test: Students might be interested in talking about how Exee eats, drinks, and communicates. They will notice that Exee "eats" the tennis racket through an opening on the top of his head (do not call it a mouth). They might guess that Exee would drink through the same opening. Exee communicates through the lights on his instrument panel and by talking. Without the sound of Exee's voice, however, it might be difficult to know if Exee is happy or sad or glad or mad, because Exee does not have a mouth with which to make the facial expressions we use to communicate those feelings.

4. **Allow students to explore what the mouth does on the CD-ROM.**

Load the CD-ROM on the computer. From the main menu, select *What Do Mouths Do?*

Activity 2: Mouth Mirrors

The purpose of this activity is to help students act out different things that the mouth can do (its functions) and to observe what is inside the mouth (its parts).

1. **Introduce this activity by holding up a mirror. Ask students to describe what a mirror does.**

   Help students understand that a mirror reflects (or shows back) an image.

2. **Tell students that they will take turns with a partner pretending to be a "mouth mirror." Let them know that they will be acting out the different things that the mouth can do (its functions) and observing what is inside the mouth (its parts).**

   First, demonstrate the activity by doing the following things with one student:

   - **Sit facing the student.**
   - **Tell the student that you will be the "mouth mover" and he or she will be the mouth mirror. Invite the mouth mirror to mimic your movements.**
   - **Slowly move your mouth in one of the following ways: open wide, close your lips, stick out your tongue, puff out your cheeks, bare your teeth, move your tongue over your front teeth, smile.**
   - **Allow time for the student to copy your movement.**
   - **Again, slowly move your mouth in different ways. Allow time for the student to mirror your mouth movements.**

3. **Assign partners or allow students to find a partner. Ask them to decide who will be the first mouth mover and who will be the first mouth mirror.**

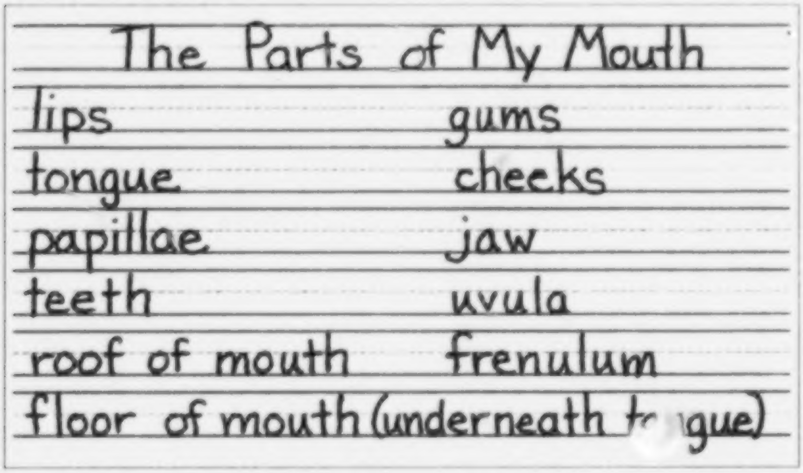
Inform students that they will trade roles after 20 to 30 seconds. Be sensitive to students who might be embarrassed to open their mouths for others to see.

4. **Invite students to begin the activity and to observe their partner carefully. Remind them to pay attention to what they can observe inside their partner's mouth as it moves.**

   The mover *slowly* opens the mouth, closes the mouth, moves the tongue, bares the teeth, and so on. The mirror does whatever the mover is doing. Stress to students that movements need to be done slowly so that the mouth mirror can follow along exactly. After 20 to 30 seconds, tell the partners to change roles.

5. **Instruct students to gather in a whole group area. First, ask students if they want to add any other actions to the chart *What My Mouth Can Do.* Then, ask students to describe what they saw in each other's mouths as they pretended to be a mouth mirror. On another sheet of flip chart paper, list the oral structures students observed during the activity. You might title this chart *The Parts of My Mouth.***

   Encourage students to look into one another's mouths again if they cannot remember what they observed or could not see clearly during the game. Invite students to observe until they can name the parts listed in the sample chart *The Parts of My Mouth.* (Note: Save this chart for use in Lesson 2.)



The Parts of My Mouth

lips
tongue
papillae
teeth
roof of mouth
gums
cheeks
jaw
uvula
frenulum
floor of mouth (underneath tongue)

Students probably don't know the proper name of the **uvula** (YOO vyoo lah), the small, teardrop-shaped object that hangs from the soft palate at the back of the throat; the **frenulum** (FREHN yoo lum), the line of skin from the bottom of the tongue to the floor of the mouth; or the **papillae** (pah PIHL ae), the tiny bumps on the surface of the tongue. Introduce the terms after the students describe them.

Activity 3: Food for Thought

The purpose of this activity is to connect the structures in the mouth with their functions.

1. **Remind students that one of the things they listed that they can do with their mouths is to eat. Ask them to pantomime how they might eat something.**

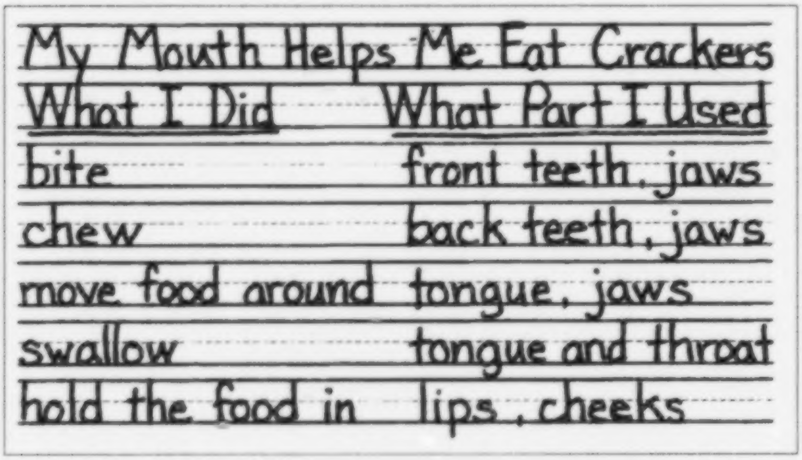
2. **Be sure students have washed their hands. Distribute the crackers (or alternative snack food) and napkins and tell students that they will have a snack. Ask the students to take one bite of their cracker and to pay attention to *how* they eat their snack. (Remind them *not* to eat the entire cracker in one bite.)**

   What do they do with their mouths? What helps them eat the cracker? For example, what parts help them hold the food in their mouths so that it doesn't fall out?

3. **After the students are finished with the first bite, ask them to describe how they ate their snack. What did they do first, second, third? What parts of their mouths did they use to eat a bite of the cracker?**

   As students respond, record their ideas on flip chart paper. You might organize the ideas into two columns, one that identifies the step in the process and another that lists the part(s) of the mouth they used during that step (see the following sample chart, *My Mouth Helps Me Eat Crackers*). Note that the title of the example is specific to crackers because we do not eat all foods in the same way. For example, we don't usually bite ice cream or pudding.

Content Standard A: Abilities necessary to do scientific inquiry.
Content Standard C: The characteristics of organisms.



My Mouth Helps Me Eat Crackers

What I Did	What Part I Used
bite	front teeth, jaws
chew	back teeth, jaws
move food around	tongue, jaws
swallow	tongue and throat
hold the food in	lips, cheeks

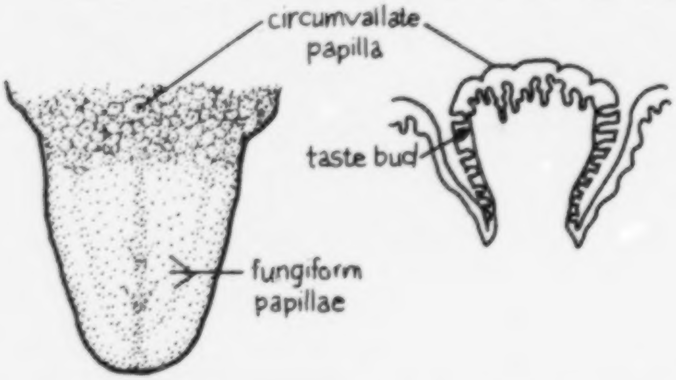
As students suggest words for the chart, invite them to finish eating their snack. The students probably will focus mainly on their teeth as they bite and chew. Encourage them to pay attention to what their jaws, cheeks, tongue, and lips do as they bite, chew, and swallow the food.

4. **To bring in the role of saliva, ask the students what happened to the cracker at each step.**

   - **Did the cracker stay as hard as when they first bit into it?**
   - **When did the cracker become soft?**
   - **Why do they think the cracker became soft and mushy?**
   - **Could they have swallowed the cracker if it did not become mushy?**

If students use the term, add **saliva** to the chart. At this point, use whatever words the students use to describe what they think made the cracker soft and mushy. Lesson 2 formally introduces the term saliva.

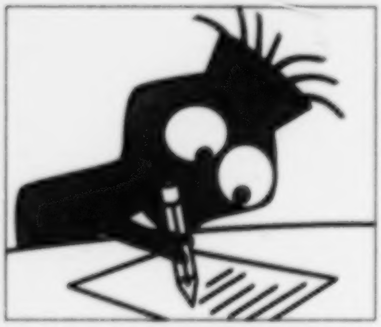
5. **Ask students if they know what helped them taste the cracker. Mention that the tongue is the organ of taste because it has taste buds. Students might look at one another's tongues and notice the tiny bumps that are on the surface. Students should be instructed to look at, but not touch each other's tongues.**



The tiny bumps on the surface of the tongue are the papillae. The taste buds are located at the base of the papillae at the sides, front, and back of the tongue. Students will not be able to see the taste buds, but you can point out their general location.

Assessment:
At the end of each lesson, there will be a wrap-up during which students tell Exee what they have learned. You can collect students' journals after each lesson to assess their progress or wait until the end of the supplement to do a final assessment.

Wrap-up



1. **Hand out the *Mouth Journals* that you have assembled or have your students assemble them from Masters 1.2 and 1.3.**

2. **Ask your students to write and/or draw in their journals their answer to the following question: What would you tell Exee about the mouth?**

Lesson 2
Explore

Open Wide! What's Inside?

AT A GLANCE

Overview

In Lesson 2, students add to their awareness of the mouth as an environment. First, students use their fingers to "take a trek" in their mouths. They explore the overall environment of the mouth and the various structures inside. Next, students explore the different types, shapes, and functions of the teeth and estimate and confirm the number of teeth in their mouths. Then, students create records and graphs to illustrate the number of teeth among the students in the class. As an extension, students recognize the importance of teeth, lips, and tongue to the formation of speech as they try to say "funny" ABCs. Students also practice recognizing the structures of the mouth while they play a matching game.

Purpose

In this lesson, students will

- have the opportunity to explore and describe the mouth as an environment and to describe the structures within the mouth;
- focus on the importance of teeth, the types of teeth, and their functions; and
- reinforce their counting and graphing skills.

Objectives

After completing this activity, students will

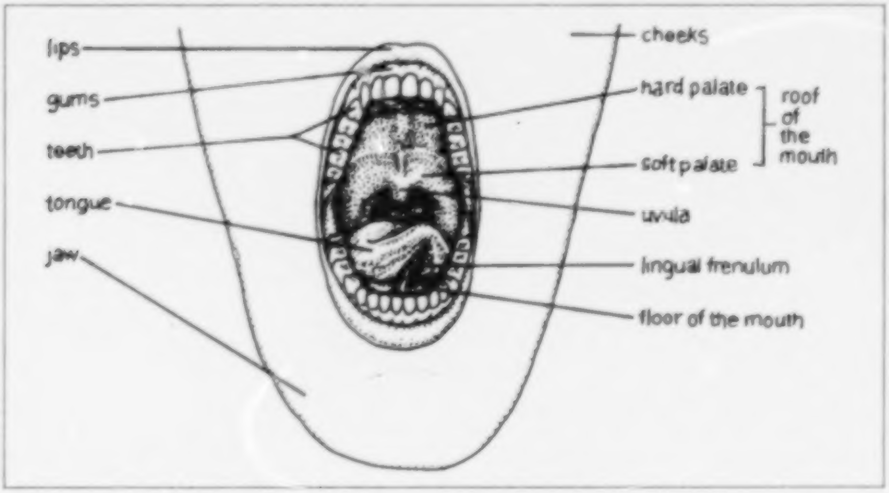
- recognize that the oral cavity (the mouth) is an environment made up of many physical structures; some of the structures can be seen and felt, and others cannot be seen without the use of special tools such as x-rays;
- become aware that saliva is an important component of a healthy mouth;
- identify the different types of human teeth and the functions of each;

- estimate and confirm the number of teeth in their mouths; and
- keep a record of their teeth, both primary and permanent, and the incidence of loss of primary teeth.

BACKGROUND INFORMATION

Mouth

The mouth, or oral cavity, is a gateway to the entire body. It allows us to talk, smile, eat and drink, digest food, and helps protect us from disease. The mouth can reveal signs of diseases (vitamin deficiencies, immune diseases) and provide physical clues to illness (a fever). The tissues of the mouth can serve as an early warning system. For example, the mouth can show the effects of tobacco use, providing perhaps the only visible evidence of its harmful effects. These relationships between the mouth and the rest of the body reinforce the importance of maintaining good oral health. Currently, researchers are exploring whether or not there is a link between chronic oral infections and other diseases such as heart disease, stroke, diabetes, and premature births.[1]

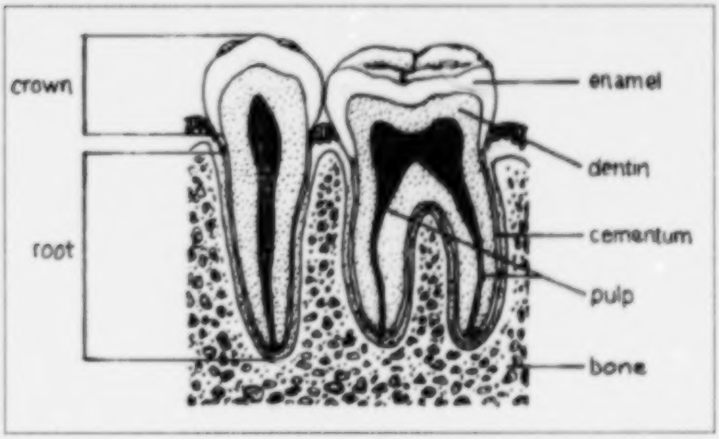


The mouth is an amazing environment made up of many physical structures. We can see and feel some of the structures, such as the crowns of the teeth, tongue, gums, lips, cheeks, and roof of the mouth. Other structures are invisible to the naked eye because they are covered by bone or skin tissue, such as the roots of the teeth, salivary glands, and the developing permanent teeth in young children.

Teeth

Did you know that the outer layer of our teeth, the enamel, is the hardest substance in the body? Although some children, and even some adults, may think that teeth are merely hard, rocklike structures, teeth are composed of living tissue. Each tooth has a **crown**, the visible portion of the tooth, and a **root** (or roots) embedded in the bone. The **enamel** consists of many tiny, long, thin rods made of minerals. Directly under the enamel is

dentin, a mineral material somewhat like bone but stronger. The innermost part of the tooth, the **pulp**, is a chamber containing nerves and blood vessels that carry nutrients and oxygen to the tooth.[2] The root is covered and protected by a thin layer of **cementum**, a bonelike tissue that helps attach the tooth to its bony socket via elastic fibers (a ligament).

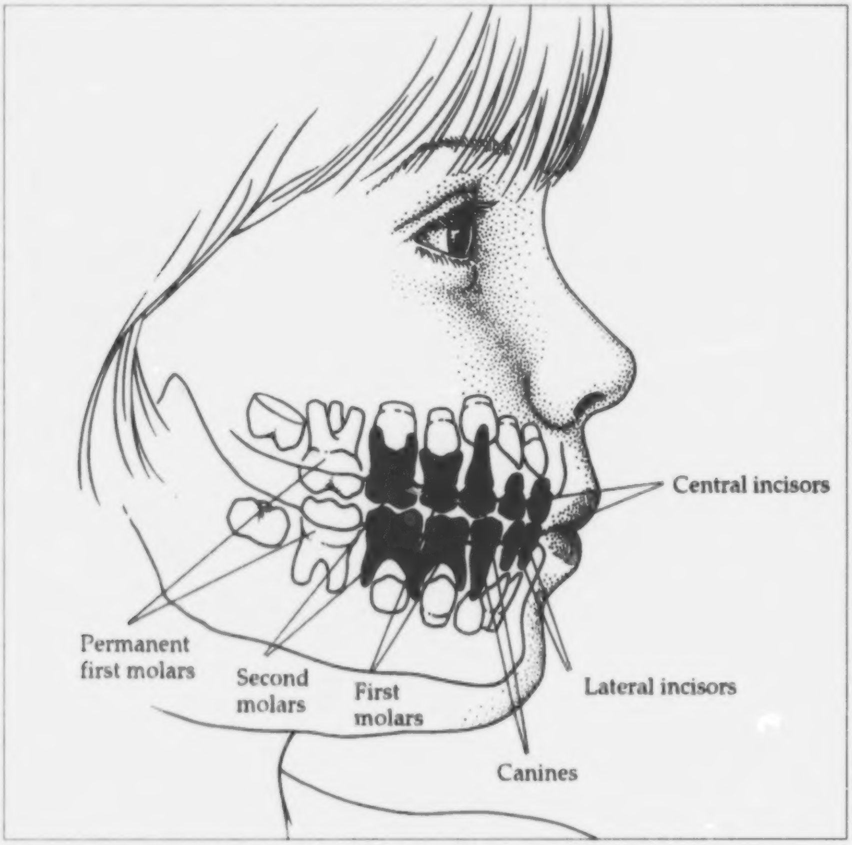


Humans have two sets of teeth: primary and permanent teeth. The two sets of teeth are similar in structure, although primary teeth have thinner enamel and larger pulp chambers. Humans have 20 primary, or deciduous, teeth that begin to emerge at around six months of age but develop well before birth.[3] Expectant mothers need to eat a nutritious diet containing adequate calcium to ensure the proper development of their baby's teeth. Primary teeth play a key role in the development of children by:

- helping digest food once a baby starts eating solid food;
- helping develop the shape of the face and;
- maintaining space for and guiding the permanent teeth (which develop underneath) into proper position.

Keeping primary teeth healthy is just as important as keeping permanent teeth healthy. Children who develop tooth decay in their primary teeth are more prone to decay in their permanent teeth. Also, if a primary tooth is lost prematurely, the adjacent teeth may drift into the open space, leaving insufficient room for the permanent teeth that follow.[4] This tooth movement may result in crowded or misaligned permanent teeth (dental malocclusion). These types of malocclusions may not necessarily affect oral health or function but can compromise aesthetics and self-image.

The loss of a child's first primary tooth is a noticeable and memorable event, a rite of passage that typically starts at about five or six years of age. Much less celebrated but extremely important is the appearance of a child's permanent molars. The initial permanent molars to erupt are the first (or 6-year) molars followed by the second (or 12-year) molars. The permanent molars erupt in the space behind the primary molars. Because a primary tooth is not lost before these molars appear in the mouth, the growth of the molars is often unnoticed. Care of these new molars is crucial, however. The biting surfaces of molars have many grooves and pits that make them prone to decay. Fortunately, good dental care and dental sealants can keep them healthy. (See Lessons 4 and 5 for more information on the causes and prevention of decay.)

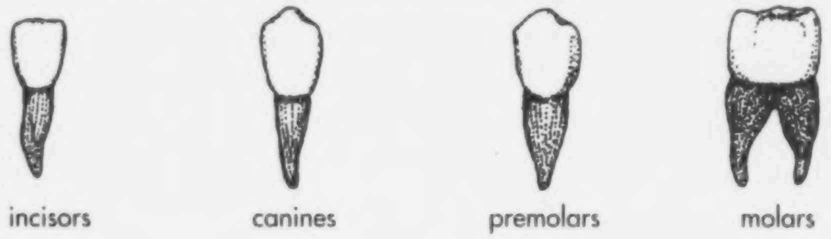


Reprinted with permission from Moss. Growing Up Cavity Free: A Parent's Guide to Prevention, Chicago, 1993, Quintessence Publishing Co.

Primary teeth are shaded in this drawing. Unshaded areas indicate permanent teeth.

When the permanent teeth are ready to erupt, the bone around them pushes them into the mouth through the gums. Have you ever noticed that brand new permanent incisors have small projections or bumps on their edges? These projections, called **mamelons**, help the tooth rise through the tissues and into the mouth; they usually wear out with normal chewing and biting to leave a smooth edge. When all their permanent teeth have emerged, humans have 32 teeth—16 in each jaw. For most people, 28 permanent teeth have emerged by age 14, while the last four third molars, the wisdom teeth, erupt only if the jaw allows space for them.[3]

All teeth have similar structure, with a crown and root(s), but they have different shapes to help them perform unique functions. For instance, the incisors are chisel-shaped to cut or incise food, while the canines have stronger, deeper roots and single-pointed cusps for tearing and ripping food apart. The premolars (or bicuspids) and molars are shaped to crush and finally grind food for easier digestion.[3]



Humans, similar to other mammals, including cats and dogs, have a primary set and a permanent set of teeth. Others, like most rodents, sharks, and other fish, have only one set of teeth that keeps growing throughout their lifetime. Animals eat different types of foods, so they have teeth that are specialized to help break down the food in their diet so that they can swallow it. For example, meat-eating animals have well-formed, pointed canines for holding and tearing food while plant-eating animals, such as cows and horses, have well-formed incisors for cutting grassy foods and flat molars for grinding it.[2]

Gingiva (Gums)

The gingiva, commonly known as gums, is a dense, soft tissue that surrounds the teeth. It covers the bone that surrounds the roots of the teeth and anchors them in place. If plaque is allowed to build up along and under the gum line, through lack of oral hygiene, oral bacteria release harmful enzymes and toxins that cause the gums to become red, swollen, and tender and to bleed easily during tooth brushing or flossing. This inflammatory process is called **gingivitis**. If the bacterial infection reaches the bone and supporting tissues around a tooth, it may lead to loss of support of the tooth and, in some cases, tooth loss. The vast majority of gum disease can be prevented by careful daily plaque removal with a toothbrush and floss and through regular dental office visits.

Tongue

The tongue is a strong and flexible muscle in the mouth. It extends from the back of the mouth and is attached to the floor of the mouth. The great range of movement of the tongue helps it move food around the mouth so that a person can chew and swallow.[2] The tongue is a sensory organ, allowing humans to taste using the taste buds that are scattered on its surface and sides. The human tongue twists and turns, allowing us to form specific sounds and words that make up speech.

Palate

Another visible structure in the oral cavity is the palate, or roof of the mouth. Humans have a hard palate made of bone covered by a tissue called

Did You Know?
Grown dogs have 42 permanent teeth. Adult humans have 32 permanent teeth. (Puppies have 28 primary teeth while children have 20 primary teeth.)

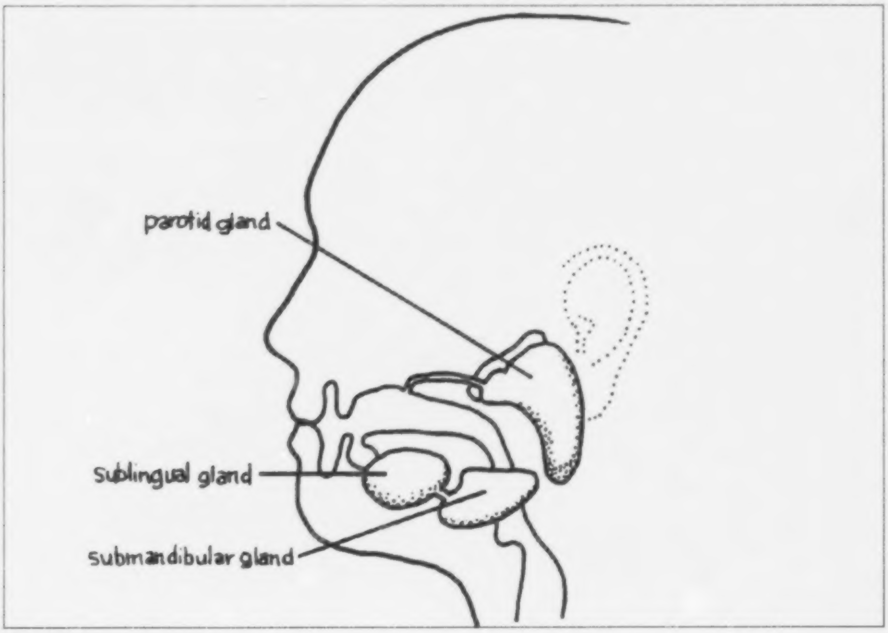
The front teeth of beavers can grow up to 4 feet per year. When they chip or wear their teeth down, the teeth continue to grow. Human teeth do not keep growing; if we wear or chip our teeth, the damage is permanent.

a mucous membrane. Behind the hard palate is the soft palate, which is a movable fold of mucous membrane that encloses muscle tissue. The soft palate prevents food or drinks from going into the nasal passages by pressing against the back of the throat during swallowing. If, during fetal development, the two sides of the palate do not fuse, a cleft palate occurs, leaving an opening in the roof of the mouth. This developmental defect occurs very early in pregnancy due to a combination of genetic and environmental factors.[2]

Salivary Glands

Saliva, the fluid produced by salivary glands, makes the oral environment moist. The major salivary glands are the parotid, submandibular, and sublingual glands. Humans have two parotid salivary glands, located in the cheeks, in front of and just below each ear. The two submandibular glands and the two sublingual glands are located on the floor of the mouth, beneath the tongue.[5] In addition to these major glands, the human mouth contains hundreds of tiny glands, called minor salivary glands, located on the inner side of the lips, the inner cheek area, and in other linings of the mouth and throat. Salivary glands may be affected by viral infection. Mumps, the most common salivary gland infection, occurs when the parotid glands become infected. Salivary glands also can be affected by bacterial infection, small stones that cause obstruction in the salivary ducts, or cancer. These salivary gland diseases and disorders can be treated either medically or surgically.[5]

Saliva plays a major role in the health of the oral cavity and the entire body. Saliva is made up primarily of water but also contains digestive enzymes,



Major salivary glands.

such as amylase, and minerals. The flow of saliva helps to wash off microorganisms from the teeth and soft tissues of the mouth that cause bacterial, viral, and yeast infections. Saliva does more than simply cleanse materials from the teeth. Saliva contains molecules that can kill or inhibit microorganisms; it is the body's own antibiotic. Saliva also helps preserve the teeth by bathing them with protective minerals, such as calcium, phosphate, and fluoride, that make the enamel on the surface of the tooth stronger. These minerals can aid in the early repair of tooth decay through the process of remineralization.[3] (See Lesson 5 for more information about remineralization.)

Saliva also contributes to digestion by breaking down food chemically as the teeth break down the food physically. Together, saliva and teeth initiate the digestive process by breaking down food into smaller particles that pass to the back of the mouth where they are swallowed. Saliva helps clear the mouth by turning starches that we eat into sugars, which then dissolve and leave the mouth. It also enhances the taste of food by allowing the food to interact with the taste buds. The salivary glands also help indicate if the body is hydrated; a dry mouth gives us the signal to take fluids.

Another special quality of saliva is its ability to neutralize acids. Acids are produced in the mouth when certain oral bacteria break down food particles. (See Lesson 4 for more information about the actions of oral bacteria.) These acids, when held onto the tooth surface, destroy enamel and cause tooth decay. However, saliva neutralizes the acids produced by plaque bacteria. Thus, saliva protects the teeth from demineralization and tooth decay.[4, 6]

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	no
Activity 2	yes
Take-home Activity	no
Activity 3	yes
Extension Activity 1	no
Extension Activity 2	optional

Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	Master 2.1, *The Parts of the Mouth*	1 transparency (optional)
Activity 2	none	none
Take-home Activity	Master 2.3, *Take-home Activity 1: My Tooth Record*	1 copy for each student
Activity 3	none	none
Extension Activity 1	none	none
Extension Activity 2	Master 2.4, *The Parts of My Mouth Game Cards*	at least 3 sets* for the class (optional)

*A set consists of game cards mounted or copied onto thick paper or card stock.

Materials

Activity 1

For the class:
- overhead projector (optional)
- transparency of Master 1.2, *The Parts of the Mouth* (optional)
- Master 2.2, *Mouth X-Ray*
- *The Parts of My Mouth* chart from Lesson 1
- tissues or paper towels
- sheets of flip chart paper
- markers

Activity 2

For the class:
- CD-ROM
- computers
- Popsicle stick

For each student:
- 1 tissue or paper towel
- 1 cracker or other snack food (optional)

Take-home Activity

For each student:
- 1 copy of Master 2.3, *Take-home Activity 1: My Tooth Record*

Activity 3

For the class:
- CD-ROM
- computers
- 1 sheet of flip chart paper
- markers

Extension Activity 1

For each student:
- 1 tissue or paper towel

Extension Activity 2

For the class:
- CD-ROM (optional)
- computers (optional)
- 1 set of Master 2.4, *The Parts of My Mouth Game Cards* (optional)
- scissors
- glue
- thick paper or card stock

Preparation

- Arrange for students to have access to computers.
- Check students' health records for students with food allergies and make sure that all students can eat the crackers (or the alternate snack you bring to class).
- Gather the materials needed for the activities.
- Make a transparency of Master 2.1, *The Parts of the Mouth,* if you think it will help students visualize the parts of their mouths.
- Have Master 2.2, *Mouth X-Ray,* available to hold up for students.
- Duplicate Master 2.3, *Take-home Activity 1: Tooth Record,* 1 for each student.
- Have students' *Mouth Journals* (prepared in Lesson 1) available for the Wrap-up exercise.
- Before introducing Master 2.3, *Take-home Activity 1: My Tooth Record,* inform parents or guardians that you will be sending home an activity and that you would like them to do the activity with their child. Indicate when you would like the Certificate of Completion returned to school.
- If you choose to use the print version of the Extension Activity 2, copy the game cards from Master 2.4, *The Parts of My Mouth Game Cards,* onto thick paper or card stock so that students cannot see through the cards when they are turned over. (Alternatively, copy the game cards on regular copy paper and glue them to card stock.) Make enough sets of cards for several groups of students to play the game at the same time.

PROCEDURE

Activity 1: Mouth Trek

The purpose of this activity is to give students the opportunity to explore and describe the mouth as an environment and to describe the structures within the mouth.

1. **Briefly review what students learned about the mouth in Lesson 1.**

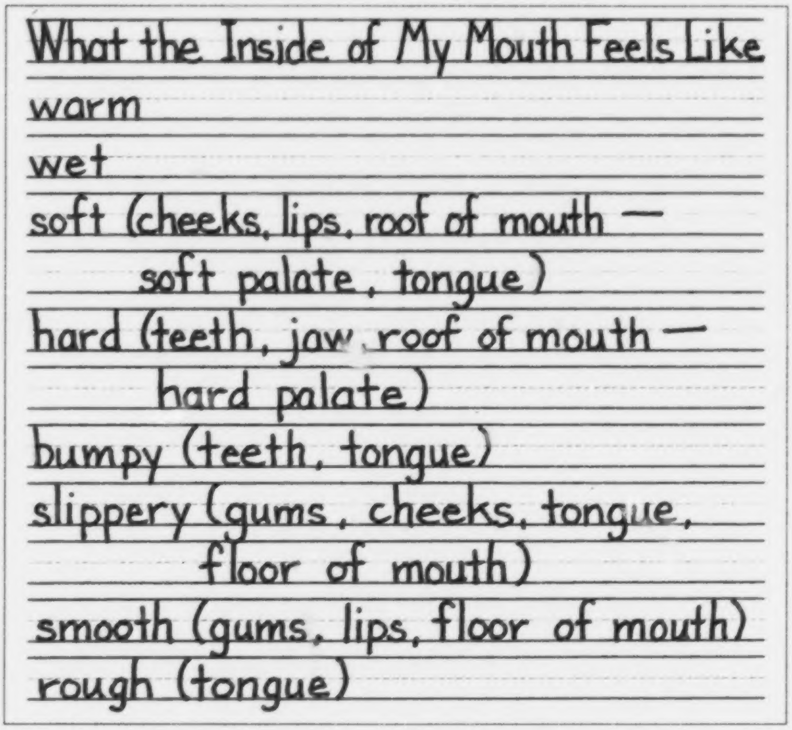
   Review both the structures and the functions of the mouth that you listed on the chart paper.

2. **Begin the activity by asking the students, "What does the inside of your mouth feel like?" and "How could you find out?" Tell students that today they will use their fingers to "take a trek" inside their own mouths and find out more about what is there. Provide tissues or paper towels for students to dry off their fingers, if necessary.**

   Make sure that students wash their hands with soap and water before they begin their "mouth trek."

Content Standard A:
Abilities necessary to do scientific inquiry.

3. **Instruct students to use an index finger to feel the inside of their mouths. Encourage them to describe what they feel. Use the board or flip chart paper to list their describing words. Remind students that this is what scientists do when they are exploring something new: they describe what they encounter. (Note: Save this chart for use in Lesson 4.)**



What the Inside of My Mouth Feels Like

warm

wet

soft (cheeks, lips, roof of mouth —
soft palate, tongue)

hard (teeth, jaw, roof of mouth —
hard palate)

bumpy (teeth, tongue)

slippery (gums, cheeks, tongue,
floor of mouth)

smooth (gums, lips, floor of mouth)

rough (tongue)

4. **Review the list by asking students to connect specific structures with their descriptive words. To remind the students of the structures of the mouth, display the chart, *The Parts of My Mouth*, from Lesson 1.**

You also can display a transparency of Master 2.1, *The Parts of the Mouth*, if you think it will help your students focus on specific structures. Prompt studies by asking questions such as these:

- **What things in your mouth are soft, hard, bumpy, smooth, and so on?**
- **Which things in your mouth are wet? Warm?**

5. **Focus the students on the general oral environment—warm and wet—by asking questions similar to these:**

   - **What do you think makes the inside of your mouth wet, even when you are not drinking something?**

     Some students should know about saliva, or "spit." If not, introduce the term *saliva* and tell students that saliva is what keeps their mouths wet.

   - **Where do you think the saliva comes from?**

     Inform the students that the saliva comes from salivary glands that are under their tongues and inside their cheeks. The students will not be able to see these, either in their own or a partner's mouth, but you can refer to the diagram showing the location of the major salivary glands on page 44 in *Background Information* if students ask you to provide specific locations for salivary glands.

   - **Why do you think the inside of your mouth is warm?**

     Students might not realize that the mouth reflects overall body temperature, which is warm because humans are warm-blooded animals. You might remind students that their mouth is often where someone takes their temperature if they are sick.

6. **Ask students if they think there are structures in their mouths that they cannot see or feel. Remind students of the x-rays that some of them might have had at the dentist's office. Hold up Master 2.2, *Mouth X-Ray*, and point out the structures beneath the gums, such as the permanent teeth and bone.**

   Point out that one lower primary incisor is missing. The permanent teeth are developing underneath the primary teeth.

   Scientists make observations using their senses, such as sight and touch. Technology is a useful tool to reveal what scientists' senses cannot. Dentists use x-rays such as the one on Master 2.2 to determine the presence of permanent teeth and the placement of those teeth with respect to primary teeth.

Assessment:
To find out how well individual students understand this concept, you might provide them with two separate lists of the words, one from each chart—*What the Inside of My Mouth Feels Like* and *The Parts of My Mouth*. Ask students to draw lines connecting the characteristics (for example, hard) with the structures (for example, teeth, jaw, roof of the mouth).

Activity 2: Cut, Tear, and Grind

The purpose of this activity is to focus students on the importance of teeth as well as the types of teeth and their functions.

1. **Ask students to wash their hands. Then, remind them of the mouth trek they took during the previous activity. Direct them to take another mouth trek. This time, focus students on the shapes of their teeth by asking questions similar to these:**

   - **Do all your teeth feel the same?**
   - **Which teeth feel bigger?**
   - **Which teeth feel sharper?**
   - **Which teeth feel flatter?**
   - **Which teeth feel smoother?**
   - **Which teeth have lots of edges?**
   - **Which teeth only have one edge?**

   As students compare and contrast their teeth, ask them why they think their teeth are different sizes and shapes.

Content Standard A: Abilities necessary to do scientific inquiry.

2. **Remind students what their teeth did when they ate the cracker in Lesson 1. (Optional: Distribute another cracker to students and ask them to pay attention to how their teeth help them eat the cracker.)**

   Focus students on the actions of first biting and then grinding or crushing the cracker. Ask them to describe which teeth do which action. Ask them again why they think their teeth are shaped differently. Encourage them to relate their answer to the job each tooth does in helping them eat food.

   During this activity, focus mainly on the teeth; however, if students bring it up, review the role of saliva in making food soft and easy to swallow.

3. **Tell students that incisors bite or cut into food. Help students find the incisors in their mouths.**

   Help them pay attention to where the incisors are located in their mouths. Talk about why their incisors might be at the front of the mouth rather than at the back.

   Tell students that canine teeth tear food. Help students locate their canine teeth.

Help them pay attention to where the canines are located in their mouths. Talk about why their canine teeth might be toward the middle of the mouth rather than at the front or back.

Tell students that molars crush and grind food. Ask students to find their molars.

Help them pay attention to where the molars are located in their mouths. Talk about why their molars might be in the back of the mouth rather than at the front.

NSES

Content Standard C: The characteristics of organisms.

4. **Ask students to estimate how many teeth they have in their mouths.**

   Remind students that an estimate is an approximate calculation based on information they already have. In this activity, students have identified three kinds of teeth in their mouths. They can use their tongue to roughly count how many molars they have, how many canines they have, and how many incisors they have. Or, they can try to count how many teeth they have on the top and estimate that the total number of teeth in their mouth is double that number. Encourage students to estimate carefully, not just guess.

5. **Ask for a student volunteer to come to the front of the room for an exact tooth count. Make sure your hands are clean and use a clean Popsicle stick to point to each tooth as you count it. Record on the board the number of teeth the student volunteer has. Based on the count of the volunteer's teeth, ask students to adjust their estimate from Step 4 if necessary.**

   Note any missing or extra teeth that the student volunteer has. Help students see that they can estimate the number of teeth they have based on the volunteer's tooth count and how their teeth match the volunteer's teeth. For example, if the volunteer is missing a front tooth and the student is not, the student would have one more tooth and would increase his or her tooth count by one.

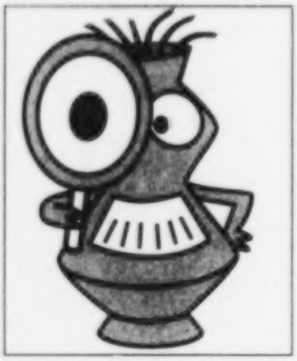
6. **Tell students that you would like them to confirm their tooth count at home, with help from their parents or guardians. Follow the steps for the take-home activity (see page 52).**

7. **Allow time for students to complete the activity on the CD-ROM about the structures in the mouth.**

   Load the CD-ROM into the computer. Select *Open Wide! What's Inside?* from the main menu. Then click on *Inside Your Mouth!*

BEST COPY AVAILABLE

Take-home Activity: Tooth Record



This is the first of three take-home activities. The take-home activities are designed to engage children and their parents or guardians in oral health activities at home. One side of the page explains the procedure, and the other side contains important background information for the parent.

If you know of a situation in which a student will not be able to complete a take-home activity, offer to help that student complete the activity at school.

1. **Introduce the activity to students and review the directions. Tell students to fill out the tooth record and bring it back to the next class.**

2. **Point out the Certificate of Completion and inform students you would like their parent or guardian to send the completed form back to the school. The parent and child should keep the activity pages at home.**

3. **Send 1 copy of Master 2.3, *Take-home Activity 1: My Tooth Record,* home with each student and wait for results.**

Activity 3: Graphing and Record Keeping

The purpose of this activity is to reinforce graphing and record-keeping skills.

1. **Give students time to view the segment on the CD-ROM that describes the pattern of tooth loss and the development of permanent teeth. Help students recognize that primary teeth are important place holders for permanent teeth.**

   Insert the CD-ROM into the drive. From the main menu, select *Open Wide! What's Inside?* Then click on *How Teeth Grow.*

2. **Tell students that the class is going to make a graph to represent the different tooth counts the students made when they did their take-home activity. Ask students to tell you why it is possible that not all students have the same number of teeth.**

   Loss of primary teeth is an exciting stage of development for primary students. Students will realize that they might have different numbers of teeth because they each might have lost a different number of primary teeth or have had a different number of permanent teeth erupt.

3. To begin, make the following data table on the board. If necessary, adjust the range of tooth counts to include all counts made by your students.

Tooth Counts

16 Teeth	17 Teeth	18 Teeth	19 Teeth	20 Teeth	21 Teeth	22 Teeth	23 Teeth	24 Teeth

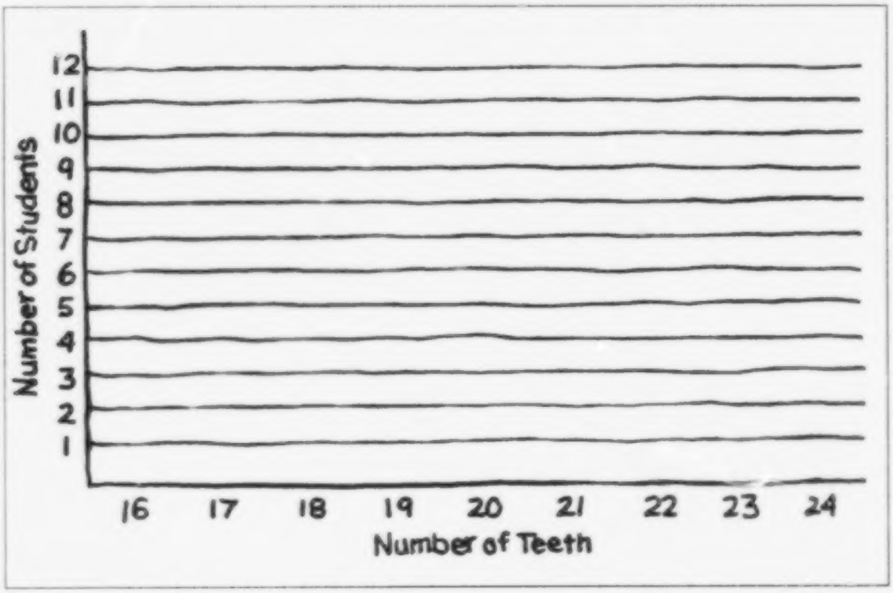
4. Ask students to go up to the board and put a mark in the box below the number of teeth they counted in their mouth.

5. With the students' help, tally the number of students who put marks in each of the boxes. Record the number in the box with the marks.

NSES

Content Standard A: Abilities necessary to do scientific inquiry.

6. On a large sheet of chart paper, make a bar graph representing the information from the data table. Title the graph *How Many Teeth Do We Have?*



7. Help students interpret the graph by asking questions such as these:

   - What is the smallest number of teeth a student in this class has?
   - What is the largest number of teeth a student in this class has?
   - What number of teeth is the most common among students in this class?

Assessment:
You can assess your students' ability to create and interpret bar graphs using one of these additional graphing exercises.

8. **(Optional) Create additional class bar graphs that illustrate the number of students who have**
   - **loose teeth,**
   - **missing teeth, or**
   - **teeth coming in.**

Photo: Corel

9. **(Optional) Keep a class chart or graph as students lose their primary teeth.**
   - **You could make an outline of a mouth with top and bottom teeth and allow a child who loses a tooth to write his or her name on that tooth.**
   - **You could record, graph, and compare the number of specific teeth that the children lose, such as bottom incisors, top incisors, and primary molars.**

Extension Activity 1: Funny ABCs

The purpose of this activity is to explore and recognize the different mouth structures that help us speak.

1. **Remind students that talking is one way they use their mouths. Introduce the idea that different parts of the mouth work together by trying the following activities:**

   Ask students to hold the end of their tongues between their fingers and to say the alphabet while they hold their tongue. Provide tissues or paper towels to dry off their fingers, if necessary.

Make sure students wash their hands with soap and water before they touch anything inside their mouth.

Ask students to cover their teeth with their lips and say the alphabet.

2. **Help students think about the structures in the mouth—in this case, the teeth and tongue—that help them make different sounds when they talk by asking questions such as these:**

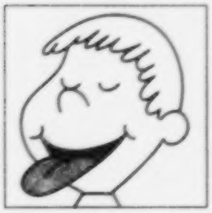
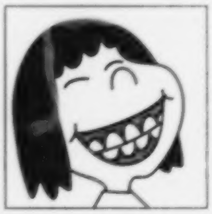
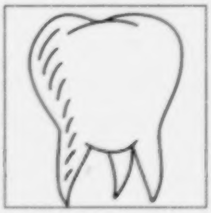
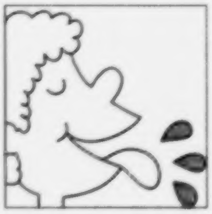
   - **Why was it difficult to hold your tongue still?**
   - **Why was it difficult to say the alphabet when your tongue could not move?**
   - **Why did it sound funny when you pretended to have no teeth?**

3. **Explain to students that their lips, teeth, and tongue work together to make sounds when they talk. Tell them they will observe how the parts of their mouths help them talk by doing these things with a partner:**

   - One student *slowly* says each letter of the alphabet, pausing after each letter to allow time for the partner to repeat the letter.
   - Both students look carefully at their partner's mouth, observing the positions of the lips, teeth, and tongue as they say each letter.
   - Challenge students to discover which letters are spoken by butting the lips together, by touching the tongue to the roof of the mouth, or by touching the bottom lip with the top teeth.
   - Challenge students to include the "sh," "th," and "ch" sounds as well.

Extension Activity 2: Matching Game: The Parts of My Mouth

The purpose of this activity is to help students review the names of the structures in the oral cavity.

This activity makes an excellent center activity. Students can play the game in teams of two, three, or four, using either the CD-ROM or sets of cards copied from Master 2.4, *The Parts of My Mouth Game Cards*. Make sure that students keep each set of the 20 game cards separate.

1. **Review the structures in the mouth that students explored previously. Hold up pictures from Master 2.4, *The Parts of My Mouth Game Cards*, or have someone model the structure as you review the vocabulary. Students have learned the following structures:**
    - **lips**
    - **gums**
    - **tongue**
    - **saliva**
    - **roof of mouth**
    - **teeth (incisor and molar)**
    - **uvula**
    - **cheeks**
    - **missing tooth**

2. **Explain to students that they are about to play a matching game that is similar to the game Memory or Concentration. (Some students may have played a version of this game before.) The object of the game is to match as many pairs of cards as they can. Review the rules of the game, as follows:**

CD-ROM version: Select *Open Wide! What's Inside?* from the main menu and then click on *Matching Game.*

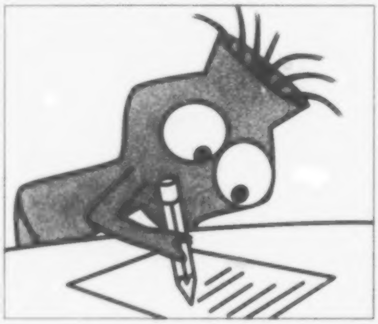
The pictures in the *Matching Game* will be in different positions for each play of the game.

Card game version: Mix up the game cards and then lay each of the 20 cards face down in a separate space. One student turns over two cards in an attempt to find a match. (Encourage the student to name the part of the mouth pictured on each card as she or he turns it over.) If the two cards do not match, the student turns the cards face down in the same spot. If the cards match, then the student removes the matching cards and makes a pile of "matches." That student gets to take another turn until he or she does not make a match. The students take turns turning over two cards at a time to match the objects shown on the cards. The game continues until all cards have been matched and collected. The student with the most matches wins the game.

Assessment:
At the end of each lesson, there will be a wrap-up exercise during which students tell Exee what they have learned. You can collect students' journals after each lesson to assess their progress or wait until the end of the curriculum supplement to do a final assessment.

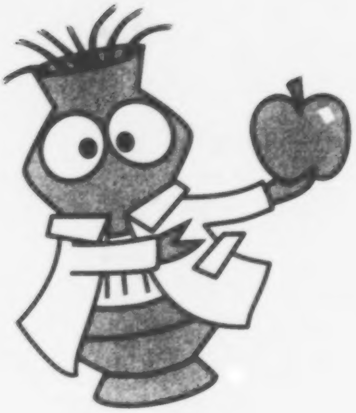
Wrap-up

Instruct students to use their *Mouth Journals* to write or draw about what they learned in this lesson. Help them decide what to include by suggesting that they answer the question, What would you tell Exee about the mouth *now*?



Lesson 3
Explore

Let's Investigate Tooth Decay!



AT A GLANCE

Overview

In Lesson 3, students develop scientific inquiry skills by asking a question, conducting a simple investigation, using tools and observations to gather data, using data to explain their results, and communicating their results. Students use apples as models of teeth to investigate the process of decay. They discuss what might happen if the skin of the apple were punctured, and they set up a simple investigation to find out. Students suggest variables they might change, such as the number of holes, the size of the holes, and the environment of the apple, and compare their results with a control apple. They make and record observations and, after several days, they compare their results. The students then contrast the results from their apple investigations with what happens to teeth during the decay process. In addition, students discuss the processes of scientific inquiry and compare their investigation with how scientists find out about the world.

Purpose

In this lesson, students will

- use scientific inquiry to answer a question and
- understand the use of a model to simulate the process of tooth decay.

Objectives

After completing this activity, students will

- be able to plan and conduct a simple investigation and to share their results with others;
- recognize that simple tools, such as hand lenses, thermometers, and balances, provide more information than the students can acquire using only their senses;
- realize that the processes of scientific inquiry can help them ask and answer a question;

- explain that scientists use models when they cannot investigate real things; and
- describe that cavities are the result of a process that begins on the enamel of teeth.

Did You Know?
"From the earliest grades, students should experience science in a form that engages them in the active construction of ideas and explanations and enhances their opportunities to develop the abilities of doing science."
—*National Research Council, National Science Education Standards*[1]

BACKGROUND INFORMATION

Involving Students in Scientific Inquiry

Because students are naturally curious about the world around them, involving them in scientific inquiry is not difficult. Any time a student brings a rock, a bug, or a leaf to school, he or she is beginning the process of scientific inquiry. Your position as a teacher enables you to focus and refine their skills in scientific inquiry as they explore and make sense of the world around them.

In a classroom in which inquiry is taught and encouraged, it is important for students to develop both

- the abilities of scientific inquiry so that they can "do science" and
- an understanding of the processes of scientific inquiry as scientists apply them in the real world.

Except for "asking questions," which is usually the first step, there is no order to the processes of scientific inquiry. Contrary to popular thinking, scientists do not use *"the scientific method,"* as students are often taught in school. Rather, scientists use all of the processes of inquiry as needed. Generally, scientists begin with a question, such as How does that work? or What causes that to happen? To develop explanations of phenomena and events, they use their observations, experiments, knowledge, and logic.

As most teachers know, acquiring the ability to do science does not necessarily lead to an understanding of how science works in the world. Teachers need to weave together the abilities of science with the understandings of science. Students need to be encouraged to think of themselves as scientists and understand that, when they do science, they are using the very same processes that scientists use. If students are to understand how science works, they must compare what they are doing in their activities with what scientists might do in similar situations. The more they understand about the processes of scientific inquiry, the more they will understand the nature of science.

Using a Model

In this lesson, students use an apple as a model to investigate tooth decay. Like most models, the apple is not a perfect model for investigating tooth decay; an apple is not a tooth. However, you can use the apple model despite its limitations to help students transfer ideas about the apples to ideas about tooth decay.

Tooth decay (dental caries) is often recognized as a hole in the tooth, or a cavity. A **cavity** is actually the late stage of a dental infection that causes the tooth enamel to lose minerals. (See Lesson 4 for a detailed description of the process of tooth decay.)

The apple model's "hole in the apple" analogy is not entirely accurate because tooth decay begins *under* the surface of the enamel and not as a break or hole in the enamel. If the decay process continues unchecked, a cavity or hole eventually appears in the enamel. This, however, is a fine distinction and one that students don't need to make. It is sufficient for students to discuss tooth decay as "cavities" in teeth at this time.

The apple is a good model because it graphically illustrates decay spreading into the apple from a hole in its surface. From this observation, students make predictions about tooth decay that starts from actions on the surface of the teeth. Students don't need to understand details about how the decay process happens yet. Lessons 4 and 5 introduce students to the actual process of dental caries.

This lesson addresses many of the skills and abilities that students need to acquire to do and understand science. Students will ask questions, conduct an investigation, gather data, and communicate their results. Practice with scientific inquiry will help students understand the process of tooth decay and develop the skills needed to understand the world around them. You may want to review the *National Science Education Standards*[1] to learn more details about the processes of scientific inquiry.

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	no
Activity 2	no
Take-home Activity	no

Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	Master 3.1, *Apple Record Page*	1 copy for each student
Activity 2	none	none
Take-home Activity	Master 3.2, *Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!*	1 copy for each student

Materials

Activities 1 and 2

For the class:
- 1 apple, preferably Red Delicious
- simple balance*
- 2 or 3 thermometers**
- sharp knife to cut apples (for teacher's use only)
- assorted materials for student investigations, such as plastic containers with lids; plastic wrap or small plastic bags; aluminum foil
- sheets of flip chart paper
- markers

For each team of 2 or 3:
- 1 apple, same type as control apple
- 1 hand lens
- 1 sharpened pencil

For each student:
- 1 copy of Master 3.1, *Apple Record Page*
- 1 pencil
- crayons or markers

Take-home Activity

For each team (optional):
- 1 egg
- 1 plastic cup
- white vinegar to cover egg in cup
- plastic wrap to cover cup

For each student:
- 1 copy of Master 3.2, *Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!*

*Students can use the balance to compare the weight of their apple from day to day.

**Teams might want to measure the air temperature at the location of the experimental and control apples.

Preparation

- Decide whether you want students to work in teams of two or three. Determine team assignments.
- Gather the materials needed for the activites. Prepare according to the number of teams. (You will need more apples, hand lenses, and pencils if students work in teams of 2 rather than in teams of 3.)
- Duplicate Master 3.1, *Apple Record Page*, 1 for each student.
- Duplicate Master 3.2, *Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!*, 1 for each student.
- Have students' *Mouth Journals* (prepared in Lesson 1) available for the Wrap-up exercise.

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PROCEDURE

Activity 1: The Apple Investigation

The purpose of this activity is to involve students in the processes of scientific inquiry.

1. **Ask the students if anyone has ever had a cavity in a tooth. As students raise their hands, ask them where the cavity happened, to describe what they think a cavity is, and to explain how they think they got a cavity. Record students' responses on the board or flip chart paper.**

   By age six or seven, some students probably have experienced tooth decay and have had a dentist fill a cavity. If not, students probably know of a family member who has. Ask them to describe what they know about cavities and how a person might get a cavity in a tooth.

Assessment:
This is a good time to assess your students' prior knowledge. The purpose of this discussion is to find out what students know, or think they know, about tooth decay and what causes it.

2. **Show students an apple. Ask them to compare the apple with a tooth. How is the apple like a tooth? How is it different from a tooth?**

   During this discussion, focus students on the apple as a **model** of a tooth. Scientists often use models in scientific investigations to find out about things when they cannot or should not experiment with the real object. We know that an apple is not exactly like a tooth, but we can use the apple to conduct an investigation on tooth decay that we would not want to conduct on our own teeth. The apple is shaped somewhat like the crown of a molar tooth and has a covering, the peel or skin, that protects the inside of the apple. We will consider this outer covering of the apple comparable to the enamel that covers and protects the inside of the tooth.

3. **Set the stage for investigating tooth decay by asking students what they think would happen inside the apple if someone used a pencil to poke a hole in its skin. At this point, accept all answers and record students' ideas on the board or flip chart paper.**

   If students have not mentioned it before, indicate that tooth decay happens when something makes a hole in the enamel of a tooth (see *Background Information: Using a Model* for a discussion of this process). They will use the apple to model what might happen to a tooth if something makes a hole in it.

4. **Tell students they will conduct a scientific investigation about an apple with a hole in it. Help students understand how to conduct a scientific investigation by asking questions similar to these:**

   - **What do you want to find out about the apple? In other words, what is the scientific question you are trying to answer?**

The question is: What happens inside an apple if its skin gets a hole in it?

- **How can we answer our question?**

  We will make a hole in an apple and observe what happens.

- **Would the same thing happen to an apple if we didn't poke a hole in it? How would we know?**

  This question introduces the idea of a "control." A control enables us to know what happens with and without the experimental change. The control makes the investigation a "fair test." Would we see the same results in an apple that didn't have a hole poked in its skin? Does having a hole poked in the skin make a difference in what happens inside the apple?

- **Are there any other questions we might ask and try to answer in our investigation?**

  Posing questions that can be answered by investigation is a difficult task for students of all ages. Help students frame useful questions by inviting them to think about "what would happen if…" What changes could they make in the apple that might affect what happens inside the apple? Remind them that they must be able to observe the results from the change they suggest. The following are possible questions they could investigate.

What would happen if

- **we poked more than one hole in an apple?**
- **we made some holes deep and some holes shallow?**
- **we made some holes larger than others?**
- **we poked one or more holes in the apple, then put it in a plastic bag and sealed it?**
- **we poked one or more holes in the apple, then put it in the refrigerator?**
- **we poked one or more holes in the apple, then put it in a sunny place?**
- **we poked one or more holes in the apple, then put it in a dark, warm place?**

Remind students that the environment of the mouth is wet, warm, and dark. You may want to display the chart made in Lesson 2, *What the Inside of the Mouth Feels Like.* What if the apple were in an environment that is similar to that of the mouth? Would the results be the same or different? How could you find out?

Tip from the field test: Some students poked holes into their apple and placed pieces of candy in it. Other students poked holes into their apple and placed it in a plastic bag full of soft drink.

5. **Help the students prepare by explaining the steps they will need to do to complete the investigation.**

- **Students will plan and conduct their investigations in teams of two or three.**

  You might have the students work in pairs, but smaller teams mean you will need more apples for the class.

- **Each team will choose a question they think they can answer by investigating. For example, What will happen to the apple if we poke five holes in it and put it in the closet?**

- **The team will write its question or have an adult help them write the question.**

- **Now have the teams share their questions with the class. Encourage some teams to think of a new question if too many teams want to investigate the same question.**

  Allowing some teams to investigate the same question is a good idea. The results might vary and the differences provide good food for thought. Scientists often repeat investigations or compare their results with those of other scientists. However, if too many teams want to investigate the same question, encourage some teams to change their question so the class results will be more interesting and varied.

- **The team members will decide who will perform each task.**

Make sure the students know which team member will get the materials, poke the hole, or place the apple in a closet, for example. Making sure that each student has a task to perform will reduce arguments and hurt feelings.

NSES

Content Standard A: Abilities necessary to do scientific inquiry.

6. **After teams have confirmed their scientific question and decided who will perform the tasks, distribute one apple per team. Allow them time to set up their experiment.**

7. **As a class, determine where to place the control apple (the apple that has not been changed). Make sure students know that they should observe the control apple as well as their experimental apple each time they make observations.**

8. **Distribute Master 3.1, *Apple Record Page*, one to each student. Discuss the record page and make sure students know how to complete each section. Allow students time to complete the first three questions and to record their beginning observation.**

9. **Discuss the teams' answers for question 3 on the record page: What do we think will happen to our apple? Record students' ideas on flip chart paper and save the paper. In a few days, they will compare their results with their initial ideas.**

   Many times in science class, we ask students to express their initial ideas about something and refer to those ideas as their predictions. Often, however, their initial ideas are merely guesses because they have no experience or existing data on which to base their ideas. Predictions in science usually are based on some prior information or knowledge from previous work. (The dictionary definition of "predict" is "to foretell on the basis of observation, experience, or scientific reason.") Consequently, we don't refer to students' initial ideas as their predictions. If students conduct a second investigation based on the results from the first, then they can make predictions based on their previous experience.

10. **Reserve time every day for students to observe their experimental apples and the control apple. Because the change is gradual, require students to record their observations only once at the beginning, once in the middle, and once at the end of the investigation. Encourage students to use hand lenses, thermometers, and the balance to record data about their apple or the environment of the apple.**

    Every time students observe their apples, ask them to explain why they are doing the apple investigation. Remind them that the apple is a model of a tooth and that they are investigating tooth decay.

    You might put up a banner that asks the question: What is tooth decay? and point to that as a daily reminder of the purpose of the investigation.

11. **Continue with Lessons 4 and 5. Return to Activity 2 of this lesson in five to seven days.**

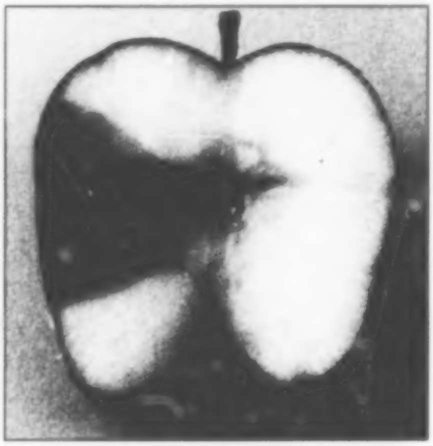
The information about oral bacteria and decay in Lessons 4 and 5 will help students interpret the results from their apple investigation.

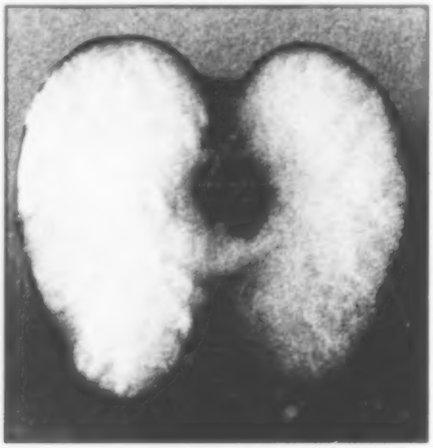
Activity 2: Completing the Apple Investigation

The purpose of this activity is to help students analyze and interpret their scientific investigation.

1. **After several days (whatever time you designate for the investigation) cut open each team's apple and the control apple. Instruct teams to observe their own apple and to record the results on their record page. Encourage them to use hand lenses and the balance to make their observations.**

   The inside of the apples will turn brown quite quickly after you cut them open. You might wait to cut open the control apple until students have recorded the results from their experimental apple.





2. **Display all the team apples and the control apple. Label each apple according to its variables: number of holes, size of holes, in a plastic bag, in the refrigerator, in a closet, and so on. Invite students to observe the results from all the apples. Discuss the results and help students answer their original question based on what they can observe.**

3. **Review the teams' responses to Question 3 on their record page. Discuss whether their responses were accurate and why initial ideas are not always accurate.**

   Often scientists do not have enough experimental data to make accurate guesses or predictions. The more data they gather, the better their predictions become. (Refer to the note about guesses versus predictions on page 64.)

4. **Discuss the results of their investigation based on what they learned in Lesson 4 by asking questions such as these:**

   - **What happened inside the apple?**

     The inside of the apple turned brown; it began to decay.

   - **What made the apple begin to decay?**

     We poked a hole in the skin or peel of the apple.

   - **What did the hole allow to happen inside the apple?**

     The hole allowed something to get inside the apple and start the decay process.

   - **What is your evidence that something got inside the apples that had the holes?**

     The inside of the apples that had holes turned brown. The inside of the control apple did not turn brown.

   - **Why is it important to protect your teeth so that they do not get holes in them?**

     If the bacteria in your mouth create a hole in the enamel of a tooth, then that tooth will decay, similar to what happened to the inside of the apple.

   Remember that the apple is not a perfect model of a tooth. The decay process is not the same, although the appearance might be similar. The inside of the apple will turn brown upon exposure to the air. Tooth decay requires acids produced by oral bacteria.

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Content Standard A:
Abilities necessary to do scientific inquiry.

5. **Review the processes that students used to answer their initial question about the apple. Help students compare what they did to what scientists do when they conduct investigations or experiments. Help students realize that they can be scientists.**

   - Scientists ask a question. (What questions did students ask?)
   - Scientists plan their investigation and use a control to try to answer their question. (How did the students plan and conduct their investigations? Did they use a control?)
   - Scientists make predictions about what they think might happen. (What were students' guesses?)
   - Scientists use their senses to observe and gather evidence or data. (How did the students use their senses?)

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- Scientists use tools to help them observe and gather data. (What tools did students use? How did using those tools help them?)
- Scientists record their observations and data. (Where did students record their observations?)
- Scientists share their evidence and data with others. (How did students share their evidence?)
- Scientists use their evidence and data from investigation results to answer their question or explain what happened. (How did students use their evidence to answer their question?)

6. **To end the activity, ask students what they would do differently if they repeated their investigation.**

   How would the students change their question? How would they set up their investigation? What do they predict would happen? This time, the students would be making predictions, not guesses, because they have results upon which to base their predictions.

7. **Ask students if they think scientists repeat their investigations and, if so, why.**

   Scientists often repeat their investigations or ask a new question based on their results. In fact, some scientists study the same (or a similar) question for many years.

8. **Congratulate the students on their work as scientists.**

Take-home Activity: So You Want to Be an Eggs-pert Scientist!

In this lesson, we continue with the second of the three take-home activities. As mentioned in Lesson 2, the take-home activities are designed to engage children and their parents in oral health activities at home. The procedure for doing the activity is on one side of the page and the other side contains important background information for the parent.

You might want to complete this activity as an extension activity in class. However, allow time for students to do the activity at home first and then offer it in class for those who did not have the experience at home.

1. **Introduce the activity to the students and review the directions.** ***Do not*** **complete the activity in class at this time. Allow students to experience the fun at home first.**

   This take-home activity engages children and parents in a scientific investigation that models the tooth decay process. This experience demonstrates the effect of an acid on a hard surface like an eggshell and models how acids on teeth can cause tooth decay. It also allows the students to model for their parents the inquiry process they put into practice with the apple investigation.

2. **Once again, point out the Certificate of Completion and inform students that you would like their parent or guardian to send the completed form back to school. The parent and child should keep the activity page at home.**

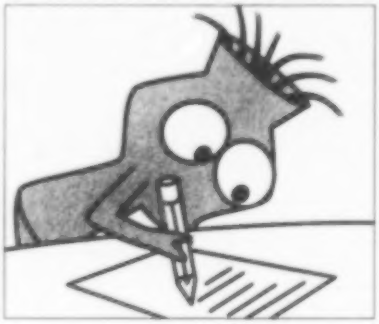
3. **Send 1 copy of Master 3.2, *Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!*, home with each student and wait for results.**

4. **If students are interested, complete the activity at school and discuss the results.**

   Ask students how an egg is like a tooth and how an egg is not like a tooth. Ask students if they think an egg is a good model for a tooth. Then, discuss students' observations and their explanations of what they think happened. Relate the results to what students have learned about the acid that bacteria produce in their mouths. How might the acids in their mouths act on their teeth like the vinegar, which also is an acid, acted on the eggshell?

Wrap-up

Instruct the students to use their *Mouth Journals* to write or draw about what they learned in Lesson 3. Encourage them not only to include information that will help Exee understand about the mouth and tooth decay, but also information about what it means to be a scientist. What are some things scientists do to answer questions like those that Exee asks about the mouth?



Assessment
This is a good time to collect the *Mouth Journals* to see if students were able to link the apple in the investigation with a model of a tooth. Can they use their observations from the apple investigation to propose explanations for tooth decay?

Lesson 4
Explain

What Lives Inside Your Mouth?

AT A GLANCE

Overview

To begin Lesson 4, students review the environment of the mouth from the mouth trek in Lesson 2. They discuss what an environment is and describe the characteristics of their mouths' environment. They create and draw an animal that they think could live in their mouths. Next they listen to a story that introduces the concept that everyone's mouth is full of oral bacteria that eat, reproduce, and produce waste products inside the mouth. The waste products of certain types of oral bacteria cause tooth decay.

Purpose

In this lesson, students will

- understand the basic characteristics of all living things,
- become aware of oral bacteria and their actions in the environment of the mouth, and
- understand the process of tooth decay.

Objectives

After completing this activity, students will

- realize that bacteria live in their mouth;
- recognize that bacteria behave like other living things: they take in nutrients, they reproduce, and they produce waste products; and
- recognize the oral disease process: bacteria → acid → tooth decay; bacteria → toxins → gum diseases.

BACKGROUND INFORMATION

Oral Bacteria

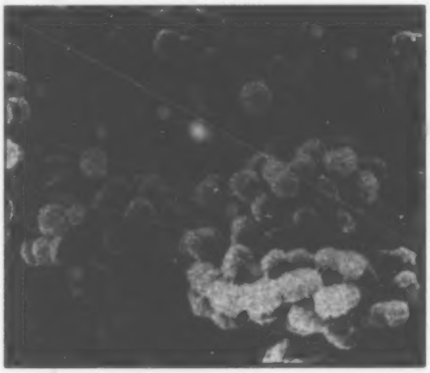
The oral cavity hosts an environment full of life. The teeth, tongue, lining of the mouth, gums, and bone are all living tissue. The mouth also plays host to many microscopic living organisms. Oral bacteria are everywhere in the mouth; certain kinds prefer certain areas on the tooth, while others prefer the gums, tongue, or tissues inside the mouth. These oral bacteria eat, reproduce, and excrete wastes just as people and all living things do. Oral bacteria may be spherical (coccus) or rod-shaped (bacillus) or even corkscrew-shaped.

Did You Know?
There are more than 500 species of bacteria in a healthy mouth.[1]

Bacteria are approximately 1 micrometer or one-millionth of a meter in size.

If a tooth were as tall as the Empire State Building (412 meters), a bacterium would be about the size of a thumb (4 centimeters).[1]

Some oral bacteria can be neutral or helpful, while others can be harmful if their numbers are not controlled. For example, *Streptococcus mutans (S. mutans)* and related species are mainly responsible for dental caries (tooth decay). Other bacteria such as *Porphyromonas gingivalis* are associated with periodontal (gum) diseases.[1]


Visuals Unlimited/David M. Phillips

In this curriculum, we use the term oral **bacteria** to refer to microorganisms in the mouth. Bacteria is a more accurate term than those that children often use, such as germs or bugs.

Plaque

Dental plaque is a soft, sticky, colorless combination of bacteria, food debris, and bacterial products. It is also known as a biofilm. Plaque forms and builds in the mouth constantly.

How does plaque form? Even a freshly cleaned tooth surface is coated with a thin layer of salivary proteins where bacteria can attach. To help them completely adhere to the tooth, the bacteria produce a "bacterial glue" called **dextran** (a chain of glucose molecules).[2] Dextran acts to hold the bacteria onto the tooth. Bacteria can digest dextran for nourishment, a form of bacterial "snack."[2]

Some oral bacteria, such as *S. mutans,* have properties that make them very resilient. These bacteria not only attach to tooth surfaces, but they can attach to one another, secrete waste products such as lactic acid, and survive in a highly acidic environment. If the acids produced by oral bacteria are held onto the tooth for extended periods of time, the tooth can lose minerals. If acid exposure continues, the tooth will eventually decay.

Not only does plaque cause dental caries, it is also a major cause of gum diseases. When plaque builds up along and under the gum line, the bacteria release enzymes and toxins that cause the gums to bleed and to become swollen, tender, and red, and if not corrected may destroy the supporting structures of the tooth.[2]

Susceptibility to plaque varies greatly among individuals because people have different types of bacteria in their mouths and their bodies have

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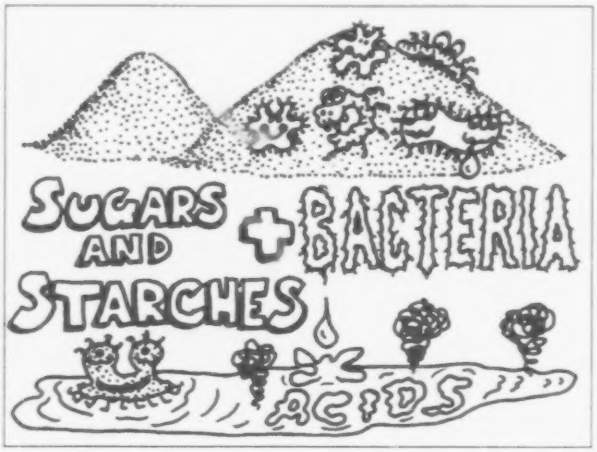
different abilities to protect themselves from these bacteria. Controlling plaque is a lifelong component of oral care. Brushing at least two times a day, particularly after breakfast and before bed, helps reduce plaque formation.[2]

Dental Caries (Tooth Decay)

Dental caries is a bacterial disease that primarily affects children and adolescents, but still is a problem for many adults. Dental caries begin when certain bacteria, mainly *S. mutans,* digest sugars and starches and produce acids that dissolve the enamel of teeth. Sugars and other carbohydrates provide nutrients for oral bacteria to survive and reproduce. Our saliva, lips, and tongue help combat tooth decay by removing food and some bacteria from the teeth. Saliva also helps prevent tooth decay by neutralizing some of the acids produced by the oral bacteria. However, once plaque is formed, it cannot be washed away by saliva, by rinsing with water, or by eating fibrous foods such as apples. The decay process will occur more quickly if plaque is not removed every day and when fluoride is not used daily.



Sometimes, the earliest sign of tooth decay can be seen as an opaque "white spot" on the surface of the tooth. This white spot indicates an area that acids have attacked by leaching minerals from the tooth's enamel. The loss of minerals, or demineralization, usually starts on the chewing surface of the tooth or in between adjacent teeth. If the demineralization continues, the enamel and eventually the dentin are destroyed. If the bacterial infection goes unchecked, it can reach the pulp (the inner part of the tooth containing nerves and blood vessels), causing significant destruction to the tooth, pain, and infection. This is why recognizing tooth decay at very early stages is extremely important; scientists have now shown that it is possible to stop or even reverse the early damage of demineralization with techniques that help the tooth's enamel remineralize. (See Lesson 5 for more information on demineralization and remineralization.)

Did You Know?
Dental caries, or tooth decay, is the single most common chronic childhood disease—it is five times more common than asthma and seven times more common than hay fever.[3]

A particularly damaging and painful type of tooth decay is called early childhood caries. This severe pattern of tooth decay, baby bottle tooth decay, may occur in infants and very young children who are put to bed or are allowed to suck at will during the day from a bottle filled with juice or sugar-containing drinks. Luckily, with proper care by parents and care givers and good feeding practices, this condition is entirely preventable.

Children who experience tooth decay at an early age are at higher risk for decay later in life. Therefore, it is very important to prevent tooth decay through good oral hygiene, healthy diets, and the use of fluorides and sealants (see Lesson 5 for more information).

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	no
Activity 2	yes

Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	none	none
Activity 2	Master 4.1, *Animals Do More than Eat and Drink*	1 book for the class

Materials

Activity 1

For the class:
- chart from *What the Inside of My Mouth Feels Like*, Lesson 2

For each student:
- 1 sheet of drawing paper
- crayons or markers

Activity 2

For the class:
- CD-ROM
- computers
- Master 4.1, *Animals Do More Than Eat and Drink* book

Preparation

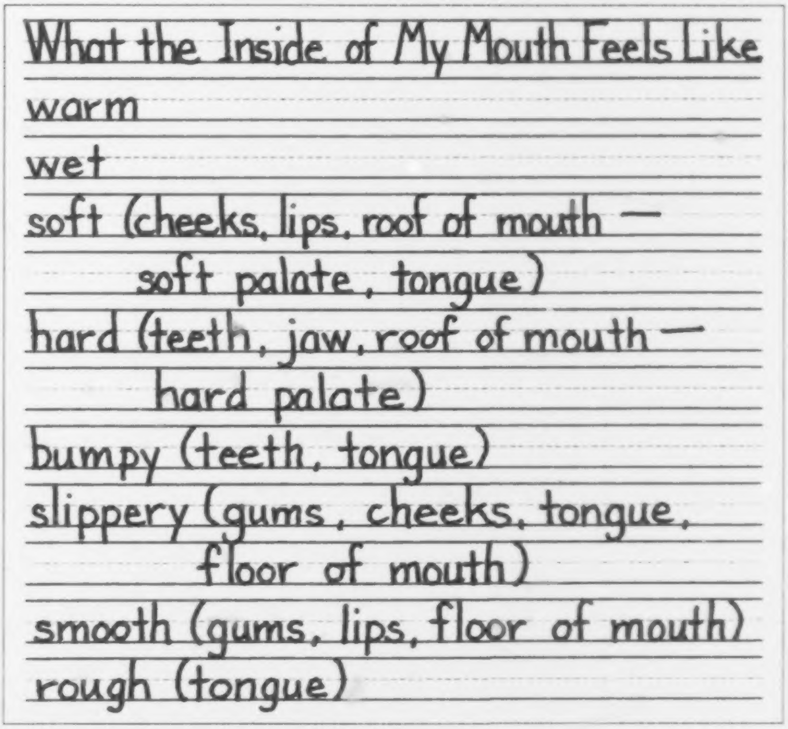
- Arrange for students to have access to computers.
- Gather the materials needed for the activities.
- Before Activity 1, display the chart, *What the Inside of My Mouth Feels Like*, from Lesson 2.
- Before Activity 2, duplicate Master 4.1, *Animals Do More Than Eat and Drink*, 1 copy for the class. If you duplicate Master 4.1 as 2-sided copies, you can simply fold the pages in half to assemble the book. Review the story. If you feel there is a need, send a letter to the parents or guardians explaining the information and the purpose of the story.
- Have students' *Mouth Journals* (prepared in Lesson 1) available for the Wrap-up exercise.

PROCEDURE

Activity 1: What Lives in Warm, Wet Places?

The purpose of this activity is to help students recognize the mouth is an environment containing organisms that share characteristics with other living organisms.

1. **Remind students of the mouth trek from Lesson 2 and post the flip chart, *What the Inside of My Mouth Feels Like*, from that activity. Review the words that students used to describe the inside of their mouths.**



What the Inside of My Mouth Feels Like
warm
wet
soft (cheeks, lips, roof of mouth —
soft palate, tongue)
hard (teeth, jaw, roof of mouth —
hard palate)
bumpy (teeth, tongue)
slippery (gums, cheeks, tongue,
floor of mouth)
smooth (gums, lips, floor of mouth)
rough (tongue)

2. **Focus on the mouth as a warm, wet environment. Ask students if they know of other places that also are warm and wet. Encourage students to think about different environments on earth.**

   The students might answer a pond, a jungle, inside a volcano, inside a cave, a rain forest, or a steamy bathroom after someone takes a hot shower.

   Then ask, Can you name some animals that live in those places?

   Students should list a variety of animals, from large to small, such as whale, alligator, monkey, deer, sea otter, turtle, fish, and germs.

Assessment:
This is a good time to assess your students' prior knowledge of the concept of environment. Be sure they understand that an environment is made up of the total surroundings of a given place. For example, their school environment includes all the students, teachers, and staff, as well as the desks, chalkboards, chairs, hallways, and building. It also includes such things as air and sunlight, temperature, and sound. A pond environment, in contrast, would include some of the same surroundings but would have some living and nonliving structures unique to it.

Content Standard C:
Characteristics of living organisms.

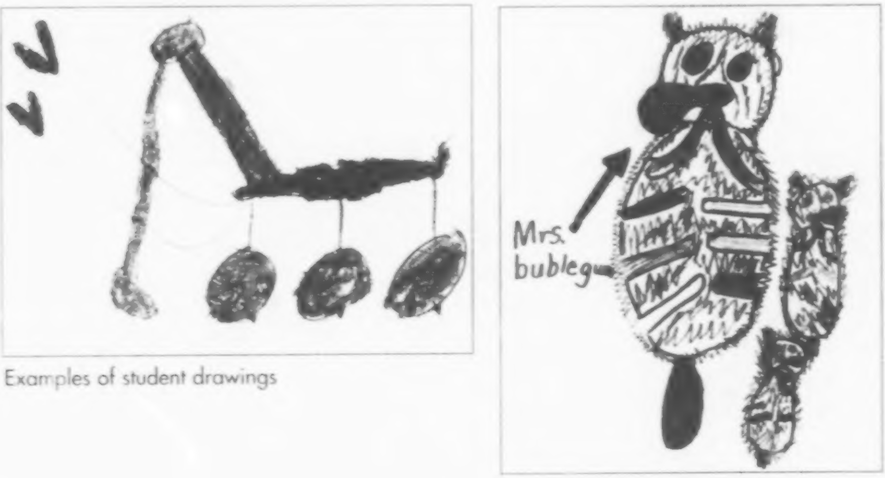
Next, ask students to list the things animals need to survive in their wet, warm environment.

Animals need food, water, shelter, and space.

3. **Ask students, What if an animal—a very tiny animal—lived in your mouth? How could that animal survive? How could the animal get food? Water? Where could it live? Where could it find shelter?**

   Students might suggest that the animal eats whatever they eat, or drinks their saliva. They might think that the animal lives under their tongue or on the roof of their mouth.

4. **Invite students to draw a picture of an animal that could live in the environment of the mouth. Ask students to imagine that they are looking through a microscope at the animal in the mouth. Encourage them to show what the animal would eat and drink and where the animal could live.**



Examples of student drawings

Activity 2: Animals Do More than Eat and Drink

The purpose of this activity is to make students aware of oral bacteria and their actions in the environment of the mouth.

1. **Gather students in a whole class area and read the story from the book, *Animals Do More than Eat and Drink*. As you read, stop periodically and ask students to explain the story in their own words. Allow students time to process all the information.**

   There is a lot of information in this story. We do not expect students to remember all of it at this time. The story sets the stage for the next lesson, which reinforces the concepts.

Help students relate the actions of oral bacteria to those of other animals. All animals take in nutrients (they eat); all animals reproduce (they produce offspring; they have babies); all animals eliminate waste (they go to the bathroom, they poop!). We want students to understand that the waste products from some of the oral bacteria (the acids and toxins) are what cause tooth decay. If the students understand that they can influence the amount of acids that the bacteria produce by what they eat and drink and by brushing through oral hygiene practices, they can greatly reduce (or eliminate) their risk for tooth decay.

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Content Standard C: Organisms and their environment.

2. **Ask students to tell you how they feel about what they have learned in the story.**

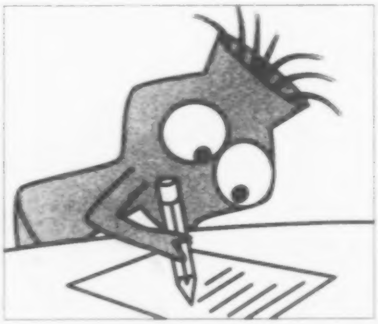
   Students might tell you that they think the information they learned in the story is "icky." Many will suggest that they want to brush their teeth *right now*! Some may be worried because they eat sugary foods or don't brush their teeth regularly. Let students know that the bacteria in their mouths are normal, but that they can avoid tooth decay caused by the bacteria by taking good care of their mouth. In Lesson 5, students will dramatize how good oral hygiene can control the growth of oral bacteria and reduce the amount of acid that can lead to tooth decay.

3. **Allow time for students to view the animated movie on the CD-ROM about microorganisms living in the mouth.**

   Insert the CD-ROM into the computer. Click on *What Lives Inside Your Mouth?* on the main menu. This animation will help students understand more about the microorganisms in the mouth. Students may also benefit from reviewing this segment during Lesson 5.

Wrap-up

Instruct students to use their *Mouth Journals* to write or draw about what they learned in this lesson. Help them decide what to include by suggesting that they answer the question, What would you tell Exee about the mouth *now*?



Assessment:
You can collect the *Mouth Journals* and assess your students' individual understanding of the concepts presented in the lesson: that the mouth is an environment that contains bacteria, living organisms that share characteristics with other living organisms.

Lesson 5
Elaborate

What Keeps Your Mouth Healthy?

AT A GLANCE

Overview

Lesson 5 asks students to participate in a dramatization through which they act out the oral disease process. Students realize that eating fewer sugary and starchy foods and brushing their teeth regularly with fluoride toothpaste can help reduce plaque and tooth decay. In the dramatization and in a CD-ROM animation, students learn how sealants and fluoride can protect their teeth.

Purpose

In this lesson, students will

- become aware of the actions of oral bacteria in the mouth that lead to tooth decay and
- understand how they can keep their mouths healthy by considering when and what they eat and by brushing their teeth with fluoride toothpaste regularly and thoroughly.

Objectives

After completing this activity, students will

- reinforce their understanding that bacteria are like other living things: they take in nutrients, they reproduce, and they produce waste products;
- explain the oral disease process: bacteria + sugars and starches → acid → tooth decay;
- understand that certain foods, and how often they are eaten, enable bacteria in the mouth to produce acid, which can lead to tooth decay; and
- recognize that eating healthy foods, removing plaque from their teeth daily, and using fluorides and sealants contribute to good oral and overall health.

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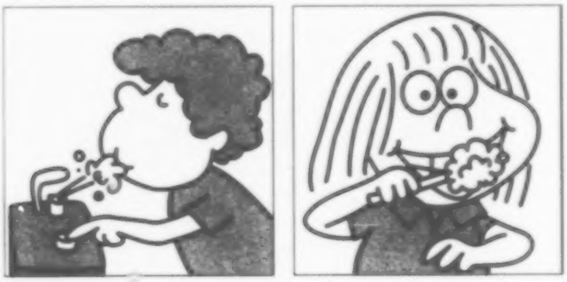
BACKGROUND INFORMATION

Tooth decay (dental caries) is a common, chronic, but entirely preventable, bacterial disease that affects people throughout their lives. Dental caries in children can lead to significant problems including pain, infection, and missed school days. When it occurs in very young children or toddlers, tooth decay can cause severe harm to the primary teeth and result in problems with eating, growth, and speech. Practicing good oral hygiene and maintaining a healthy diet can help prevent these problems.

The Importance of Fluoride

Fluoride is a mineral that is beneficial to teeth. At a low dose over a length of time, fluoride can prevent tooth decay. Fluoride works mainly through direct contact with the surface of the teeth. Fluoride is also important during formation of the tooth enamel before teeth erupt through the gums. People can obtain fluoride in two ways: topically and systemically. Topical fluoride is applied directly to the surface of the teeth. Fluoride toothpaste, fluoride mouth rinses, and fluoride treatments given by a dental professional are examples of topical fluorides. Fluoride taken systemically enters the body by drinking from community water supplies, by taking dietary supplements (such as tablets or drops), and through the food we eat and the beverages we drink. Although systemic fluorides are important, they do not provide the same benefits as topical fluorides in protecting teeth from decay. To get the most benefit from fluorides, daily exposure to small quantities is important. Most adults and children can prevent tooth decay by brushing with a fluoride toothpaste and drinking fluoridated water.



Did You Know?
Fluoride is added to community water supplies to help people fight tooth decay.

Most bottled water does not contain fluoride at a level recommended for tooth decay protection. If you drink only bottled water, you may be missing the benefits of fluoridated water.

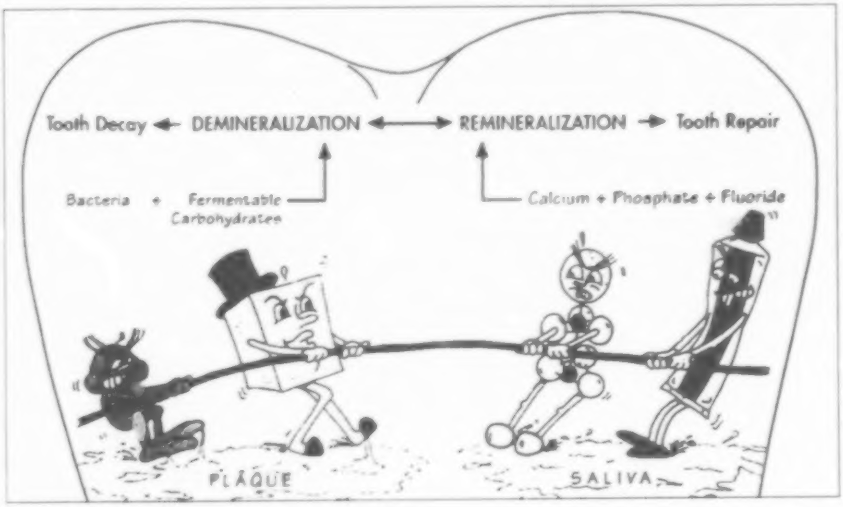
Fluoride protects teeth through three mechanisms.

- Fluoride can reduce the ability of oral bacteria to produce acid.
- Fluoride promotes remineralization, the repair of the tooth surface, and inhibits demineralization of the tooth enamel.
- Fluoride strengthens the enamel before the tooth erupts.[1]

The following sections provide additional information on how fluoride works with other minerals to protect and strengthen teeth.

Helping Teeth Repair Themselves

Throughout the day, a tug of war is taking place inside our mouth. Whenever we eat or drink, oral bacteria produce acids that begin to eat away the enamel of our teeth. However, as time passes between episodes of eating or drinking, the amount of acid decreases and the weakened tooth enamel may repair itself. Our teeth go through this constant and natural process of **demineralization** and **remineralization**. Scientists have learned that the tooth surface can, in the presence of fluoride and other minerals, repair itself if demineralization has not passed a certain point.

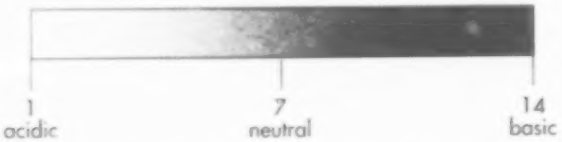

Tooth Decay ← DEMINERALIZATION ↔ REMINERALIZATION → Tooth Repair
Bacteria + Fermentable Carbohydrates
Calcium + Phosphate + Fluoride
PLAQUE
SALIVA

Cartoon created by the Ohio Department of Health—Robert Hill, graphic artist

Demineralization

Demineralization is the loss of minerals from the tooth enamel caused by the acidic waste products of oral bacteria. Each time we eat foods containing sugars or starches, the pH in our mouth drops because oral bacteria produce acid. This more acidic environment causes small amounts of minerals of the tooth enamel to dissolve. How fast demineralization occurs depends on how acidic the oral environment becomes (how much the pH decreases).[1] The more often we eat, especially foods high in sugars, the more frequently the pH in our mouth drops and the less time the oral environment has to correct itself by raising the pH. That is why it is as important, if not more important, to monitor *how often* we eat as well as *what* we eat.

pH Scale



Demineralization occurs just below the surface of the enamel. The enamel and the dentin located just below the enamel of the tooth are made up of many mineral crystals. These crystals are very soluble in acid. So, when we ingest food, the oral bacteria produce acids, and the acids break down the mineral structure of the tooth surface. If the acids remain on the tooth, it will continue to lose minerals.

We can see evidence of demineralization as white spots, called *white spot lesions*, on the teeth. When teeth lose minerals, more light goes through the surface of the enamel, causing it to appear chalky white. If demineralization outweighs remineralization, tooth decay continues and a cavity eventually forms.

Remineralization

Remineralization is the process that replaces the minerals in tooth enamel after demineralization. Saliva greatly enhances remineralization as it regularly bathes the teeth with buffering components, such as bicarbonate, phosphate, and peptides, that neutralize the acids produced by the oral bacteria. This buffering action then raises the pH level in the oral environment, creating the opportunity for remineralization to occur.

Saliva is 99 percent water with protein, enzyme, and ion components. Saliva contains calcium, phosphate, and fluoride, which combine to form a new, more fluoride-rich surface on the tooth that can better resist demineralization by acid. Fluoride speeds this process by attaching to the surface of the tooth and attracting calcium ions. Consequently, the use of fluoridated toothpaste and fluoride mouthwash increases the reservoir of fluoride in the mouth and aids the remineralization process.

This new understanding of tooth decay as a process is changing the way that tooth decay is treated. Treatments now focus on preventing, stopping, or reversing tooth decay and reducing the risk factors that lead to demineralization rather than waiting to treat the hole in the tooth with a filling. Maintaining a healthy diet, reducing the frequency of snacking, using fluorides, keeping the teeth clean, and having regular checkups can go a long way to maintain a healthy mouth.

Brushing the Teeth

Because fluoride plays such a pivotal role in preventing demineralization and enhancing remineralization, brushing the teeth with fluoride toothpaste is an essential practice for maintaining oral health. Dental professionals recommend brushing after eating or at least two times per day, preferably in the morning and in the evening. The step-by-step procedure for brushing effectively is outlined in the take-home activity, *Brushing to the Beat!* Dental professionals may recommend additional fluoride for people who are at higher risk for tooth decay.

Sealants

Sealants are another highly effective way to protect teeth from decay. Sealants are thin plastic coatings that are applied to the chewing surfaces of the molars.[2] The chewing surfaces of the molars have small pits and grooves that trap food particles and bacteria. These areas cannot be cleaned well with a toothbrush. Sealants cover the pits and grooves and form a physical barrier that protects the teeth from the decay-causing acids produced by oral bacteria. Bacteria that are trapped beneath the sealant cannot spread because they cannot reach their food supply.[3]

Photo: Corel

Most tooth decay in children and adolescents occurs in the molars. Sealants are most effective when applied soon after the molars erupt and before decay begins. The first molars appear when a child is around six years of age; the second molars erupt when a child is around twelve years old. Sealants are an excellent way to prevent tooth decay. Along with saving the tooth structure, sealants save money, time, and the discomfort of some dental procedures. One sealant application may last from five to ten years, but sealants should be checked regularly to ensure that they are intact.

A Healthy Diet

Choosing healthy foods helps us grow and keeps our mouths and bodies healthy. Our eating habits, including our food choices, directly affect the health of our teeth. Sugars belong to the carbohydrate group of nutrients. This group includes simple sugars such as sucrose (table sugar), fructose (fruit sugar), and glucose. The group also includes complex carbohydrates such as starches. Foods containing sugars and starches contribute to tooth decay because oral bacteria use these carbohydrates efficiently and produce acids that damage the tooth's enamel. The more often you eat foods that contain sugars and starches, and the longer these foods remain in your mouth before you brush your teeth, the greater your risk for tooth decay.

Some high-sugar foods, such as candy, cookies, and soft drinks, provide calories but lack the nutrients that our bodies need. Other foods, including fruits, milk, yogurt, bread, cereals, and vegetables, also contain sugars and starches, but these foods nourish the body by providing important vitamins, minerals, and fiber.[4]

The best way to maintain good health for both the body and the mouth is to eat a balanced diet that gives your body the nutrients it needs.[5] Choose foods according to the food pyramid of the U.S. Department of Agriculture (USDA). The USDA recommends eating a majority of foods from the grain, vegetable, and fruit groups, followed by foods from the milk and meat groups. The food pyramid specifies that fats and sweets should only be eaten occasionally. Take care not to let soft drinks or other sweets crowd out other foods you need to maintain health.[5]

Remember the demineralization-remineralization tug of war? Every time we eat foods containing sugars, we get an acid attack that lasts approximately 20 minutes. If nothing else containing sugars is eaten, the saliva in the mouth will fight off the acid attack. However, if we eat frequently, especially sugars and refined carbohydrates, the repeated cycles of acid attack will cause greater tooth demineralization to occur. Limiting between-meal snacks will reduce the number of acid attacks on your teeth. Also, eating or drinking sweet or starchy foods between meals is more likely to harm teeth than eating the same foods with meals. Saliva production increases

during meals and helps buffer the acids and rinse food particles from the mouth. It's best to eat sweets as dessert after a main meal instead of several times a day between meals.[6]

To protect teeth from decay, remember to:

- choose nutritious foods and snacks in moderation.
- eat few foods or beverages containing sugars or starches between meals. (If you do eat them, brush your teeth afterward.)
- brush at least twice a day with fluoride toothpaste.

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	yes
Take-home Activity	no

Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	none	none
Take-home Activity	Master 5.1, *Take-home Activity 3: Brushing to the Beat!*	1 copy for each student

Materials

Activity 1

For the class:

- CD-ROM
- computer
- 1 skein of red yarn
- 12-15 pads of small sticky notes, any color
- 1 small whiskbroom with handle (or another type of small brush to use as a pretend toothbrush)
- 1 sheet of white construction paper, 8½-by-11 inches
- 1 sheet of black construction paper, 8½-by-11 inches
- 2 sheets of construction paper, 11-by-17 inches, any color
- old magazines that contain pictures of a variety of foods
- scissors
- glue
- 1 bicycle helmet (or an umbrella)

Take-home Activity

For each student:

- 1 copy of Master 5.1, *Take-home Activity 3: Brushing to the Beat!*

Preparation

- Gather the materials needed for the activities.
- Duplicate Master 5.1, *Take-home Activity 3: Brushing to the Beat!*, 1 for each student.
- Cut pictures of a variety of foods from the old magazines and make two food collages as follows:
    - * "high-nutrition foods" (select foods such as those from the bread, cereal, rice and pasta group, the vegetable group, the fruit group, and the milk group). See note in Activity 1 (page 83).
    - * "low-nutrition foods" (select foods that do not belong to the five main groups of the food guide pyramid, such as candies, nondiet soft drinks, cookies, cakes, and potato chips).
- Glue pictures onto the sheets of construction paper to make the two collages needed in the dramatization.
- Cut a circle from the white construction paper and a "blob" shape from the sheet of black construction paper. The white circle indicates a white spot lesion forming on the tooth and the blob represents a cavity in the dramatization.
- Set up a computer center so that students can view the CD-ROM in small groups at the end of Activity 1.
- Have students' *Mouth Journals* (prepared in Lesson 1) available for the Wrap-up exercise.

Tip from the field test: If you run out of time to make the food collages, hold a brainstorming session with students to list foods that belong in each category. Write the lists on two separate pieces of construction paper and use them in the dramatization in place of the collages.

PROCEDURE

Activity 1: Let's Pretend—A Dramatization About Teeth, Bacteria, and Tooth Decay

The purpose of this activity is to help students visualize the oral disease process.

Note: Foods that contain sugars and starches can contribute to tooth decay. Almost all foods, even those that have important nutrients, contain some type of sugar or have sugar added to them during processing. Choosing nutritious foods helps promote overall good health and brushing the teeth with fluoride toothpaste helps protect the teeth from decay.

Before beginning this activity, read through the entire dramatization so that you can visualize the roles you and your students will play. The number of students playing the different parts in this dramatization can be changed to allow all students to participate in some way.

In this dramatization, some students pretend to be bacteria and put sticky notes onto other students who pretend to be teeth. If you think this might cause problems, instruct the students to place sticky notes only on the backs of other children or cut out oversized images of teeth and have the "bacteria" place the sticky notes onto the paper teeth. The dramatization is more fun if children play the role of the teeth, but follow any school or district guidelines regarding student interactions of this nature.

NS
ES

Content Standard C: Organisms and their environment.

1. **Conduct the following dramatization with the students. Read the script as indicated and instruct students to carry out the actions.**

   Setting the Stage: Using red yarn, make a large outline of an open mouth on the floor of the classroom. The area should be large enough to hold up to 15 students at one time. Explain that the yarn outlines a mouth for the dramatization.

   Gather students in a group area near the yarn mouth so that all can see and participate in the action, as appropriate.

   Assign the following roles (modify for your class size):

   - 4 students to represent teeth
   - 4 students to represent bacteria
   - 1 student to represent high-nutrition foods
   - 1 student to represent low-nutrition foods

   Give each bacterium a pad of sticky notes. Give the collages of high- and low-nutrition foods to the appropriate students.

   Note: The role of the toothbrush is somewhat complex in this dramatization so we think that it is best played by the teacher. Once students understand the actions of the toothbrush, you might assign the role to a student.

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Script: Begin the activity by saying: **Some of what happens in our mouths is impossible to see. Let's try to imagine what might be happening in our mouths by acting it out. We will start by putting some teeth in our mouth.**

Action: Have the four student "teeth" stand close together in a semicircle.

Script: Continue the introduction by stating: **We know that there are lots of bacteria in our mouths. Let's pretend that we can actually see the tiny bacteria that cause tooth decay. We don't have enough people in our class to show the *real* number of bacteria that live on and around our teeth. There are not enough people in our whole *school* to show that! We'll just remember that each person pretending to be one bacterium will represent a million tiny bacteria.**

Action: Instruct the student "bacteria" to enter the mouth and to kneel, sit, or stand by the student "teeth." Tell them not to do anything until you give them a signal.

Script: Explain the actions of the bacteria this way: **Remember from the story that the bacteria produce acid. The sticky notes are like the acid and plaque that stick onto our teeth and cause tooth decay.**

Action: Say **Start** and have the bacteria put sticky notes all over the teeth as fast as they can. After about 30 seconds or so, say **Stop** and ask the bacteria to be seated.

Script: Ask a student to apply a pea-sized amount of imaginary toothpaste to the whiskbroom that signifies a toothbrush. Now, hold up the whisk broom and say: **When we brush our teeth with a toothbrush and a pea-sized amount of fluoride toothpaste, we make the teeth stronger and brush away some of the plaque. When we brush away plaque, we also brush away bacteria and the acid they produce.**

Action: Enter the mouth and brush off some (but not all) of the sticky notes from the teeth. As you are brushing, brush one of the student bacteria out of the mouth, too. (There are now three bacteria in the mouth.)

Script: **When we eat foods that our body needs to be healthy, such as bread, milk, rice, cereal, fruits, and vegetables, the bacteria can use them to make acid and form plaque.**

Action: Ask the "high-nutrition foods" student to "feed" the collage of high nutrition foods to the mouth. (The student might place the collage inside the mouth or walk through the mouth while holding the collage.)

Script: **These bacteria also make some new bacteria.**

Action: Instruct *one* student bacterium that is currently in the mouth to walk out of the mouth and to choose another child to become a new bacterium. (This represents some reproduction within the bacterial colony, but not a lot.) Give the new bacterium a pad of sticky notes. There should now be four bacteria in the mouth.

When you say **Start**, all four bacteria continue to put sticky notes onto the teeth. After about 30 seconds, say **Stop** and ask the bacteria to be seated. (Encourage all students to notice what is happening to the teeth; they are being covered with acid.)

Script: **When we snack on foods like candy, soft drinks, chips, and crackers, we aren't giving our body what it needs to be healthy. These foods also feed the bacteria so that they keep making acid.**

Action: Ask the "low-nutrition foods" student to feed the collage of low-nutrition foods to the mouth. (Again, the student might place the collage inside the mouth or walk through the mouth while holding the collage.)

Script: **And they also make more bacteria!**

Action: Instruct *each* student bacterium that is in the mouth to choose one additional student from the class to become new bacteria. Give each new bacterium a pad of sticky notes. Now there should be 8 bacteria in the mouth. Say **Start** and ask all 8 bacteria to put sticky notes onto the teeth as fast as they can. After about 30 seconds, say **Stop** and ask everyone to observe what is happening to the teeth. Now there is more acid on the teeth.

Script: **The more often we snack in between meals without brushing our teeth, the more time the bacteria have to coat our teeth with plaque and acid.**

Action: Instruct *two* student bacteria that are in the mouth to choose two additional children from the class to become new bacteria. Give each new bacterium a pad of sticky notes. Now there should be twelve bacteria in the mouth. Say **Start** and all twelve bacteria put sticky notes onto the "teeth" as fast as they can. After about 30 seconds, say **Stop** and ask everyone to observe what is happening to the teeth. Now there is A LOT of acid on the teeth.

Script: **Brushing our teeth helps make them stronger and gets rid of bacteria and plaque.**

Action: Have someone apply toothpaste to the imaginary toothbrush and enter into the mouth. Brush the teeth by taking a few strokes at each tooth. Also, brush eight bacteria out of the mouth. (Important note: As you brush, purposely leave a lot of sticky notes on one area of one back tooth. This represents a "hard to reach" place in our mouth.)

Script: **If we snack often in between meals and we don't brush our teeth carefully with fluoride toothpaste, the acid begins to make a hole in the tooth. First, the acid attack makes a white spot on the tooth.** (Indicate that the tooth has lots of attached sticky notes.)

Action: Tape the white circle over some of the sticky notes on that area of the tooth.

Script: **These white spots don't always become cavities. But, if we continue to snack and not brush our teeth, the plaque and acid that build up begin to attack the tooth.**

Action: Put the black blob of paper over the white circle. The black blob represents a cavity, or a rotten spot on the tooth.

Script: As you can see, some parts of our teeth are hard to reach **with a toothbrush and do not get cleaned well enough. The bacteria that are left continue to make acid that eats away at the tooth. This is called a cavity** (point to black blob).

One way we can protect those places is to have sealants put on our back teeth. Sealants protect our teeth like a helmet protects our head if we fall off a bicycle. A sealant covers the tooth and doesn't let the bacteria harm the tooth. Sealants can help protect against cavities.

Action: Ask a student who represents a back tooth to put a bicycle helmet on his or her head (alternatively, you can have the student hold an umbrella over his or her head). Leave the helmet on as the class repeats the dramatization. Draw students' attention to how the helmet protects the tooth from the acid (sticky notes). Show the students that the acid and plaque stick to the sealant (the helmet) and not to the tooth surface. The sealant protects the surface of the tooth from acid and, therefore, from decay.

2. **Repeat the dramatization as long as students are interested and time allows. Discuss each action until students understand the process of decay and the importance of brushing their teeth regularly with toothpaste and limiting the number of snacks they eat.**

Encourage students to suggest the actions they want to happen in the dramatization that might *promote* tooth decay (adding low-nutrition foods, adding snacks, not brushing) and the actions that might *prevent* tooth decay (limiting snacks, choosing high-nutrition foods, brushing the teeth). Help them relate the decay process to the actions of the bacteria by asking questions such as these:

- When you eat and drink, what do the bacteria do?
- When you use a toothbrush with toothpaste, what happens to the teeth?
- What actions make *more* bacteria and acid in the mouth?
- What actions make *fewer* bacteria and *less* acid in the mouth?

3. **Give students time to view the animation movie about how brushing their teeth with fluoride toothpaste and the application of sealants can protect their teeth from decay.**

On the main menu, click on *What Keeps Your Mouth Healthy?*

NSES

Content Standard F: Personal Health.

Take-home Activity: Brushing to the Beat!

In this lesson, students complete the final take-home activity. Because the focus of this lesson has been on keeping the mouth healthy, the take-home activity shares information about oral health with parents and encourages parents and students to practice proper tooth brushing techniques.

1. **Introduce the take-home activity to the students. Review the activity with the students and perform a demonstration, if appropriate, so that they know what is expected of them at home.**

   This take-home activity, *Brushing to the Beat!*, engages children and parents in proper brushing techniques, particularly with respect to the length of time they should be brushing. You might choose a song that students know and help them time the song and determine how many repetitions of the song fit into a two-minute period.

2. **Point out the Certificate of Completion and inform students that you would like their parent or guardian to send the completed form back to school. The parent and child should keep the activity page at home to refer to again and again.**

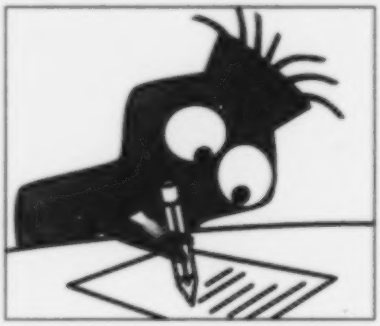
   Encourage students to choose a different song at home with their parent, one that the parent likes too. The purpose of the activity is to promote parent-child interaction and not for the child to repeat exactly what she or he did at school.

3. **Send 1 copy of Master 5.1, *Take-home Activity 3: Brushing to the Beat!*, home with the students and wait for results!**

   When students return with the Certificate of Completion signed by their parent, ask them to share with other students the results of their activity. How many different brushing songs did the students in the class use?

Wrap-up

Instruct students to use their *Mouth Journals* to write or draw about what they learned in this lesson. Help them decide what to include by suggesting that they answer the question, "What would you tell Exee about the mouth *now*?"



Assessment:
You can collect the *Mouth Journals* and assess your students' individual understanding of the concepts presented in the lesson. For Lesson 5, students should demonstrate an understanding of the actions that lead up to a cavity in a tooth and how the choices they make can stop or slow down those actions.

Lesson 6
Evaluate

What Have You Learned about the Mouth?

AT A GLANCE

Overview

By listening to a story in Lesson 6, students follow Exee home to planet Y. There, they see that Exee is trying to help friends understand the environment of the mouth, that mysterious hole in the heads of humans. Students help Exee by placing in sequential order cards that describe a day in the life of Mr. Tooth, who lives inside the mouth. When Exee's friends become sad that Mr. Tooth's day is bad, students make a new sequence that describes a good day for Mr. Tooth, thereby describing how to avoid decay. Students glue both sequences of cards onto paper that they can use to describe how to maintain good oral health.

Purpose

In this lesson, students will

- demonstrate their understanding of the process by which bacteria cause disease in the mouth and
- demonstrate their understanding of ways in which dental disease can be prevented.

Objectives

After completing this activity, students will

- sequence the steps in a normal day that can lead to tooth decay and
- describe how they can maintain a healthy mouth.

BACKGROUND INFORMATION

The Evaluate Lesson

As the Evaluate lesson for the curriculum supplement, Lesson 6 does not present any new information to the students. Instead, the lesson offers students the opportunity to express their understanding of the concepts in the supplement in a new context. As students share and compare their ideas

with those of others, they can refine and revise them. As you listen to them reasoning out loud, you can assess their individual understanding of oral health.

Students who are used to assessments that have either a right or wrong answer may not be comfortable with the type of assessment in this lesson. As a teacher, you may not be used to probing for understanding or judging degrees of understanding along a continuum from incomplete to complete understanding. It helps if you ask questions designed to help students express their ideas. In this Evaluate lesson, students will sequence pictures that depict the process of tooth decay and those that depict ways that people can take care of their oral health. Questions that you might ask as you visit each of the students working on their sequence are the following:

- What makes you think this picture goes here?
- How did you get that idea?
- What else can you tell me about…?
- Why did you choose…?
- What made you change your mind?
- Is there something else that you want to tell me about your sequence?
- What changes would you make to help Mr. Tooth have a good day?

Although it is time consuming, conduct individual interviews with students as they work on their sequence. Such interviews are the most effective strategy for assessing understanding. They also give students an opportunity to justify their picture placements and provide you with insight into their conceptions. In addition, you have the advantage of varying the assessment to correspond with the level of each student. Interviews are especially useful in helping you assess the understanding of quiet students who often are overshadowed by their teammates.

With interviews, you can probe beyond the pat answers or memorized phrases or terms. The interview can be brief and informal as you circulate around the room, or they can be scheduled one-on-one during recess or another break time. You will find that it works well to combine an interview with the activity in this lesson; the pictures serve as manipulatives that students can use to demonstrate what they understand.

Authentic Assessment

This lesson is not the only opportunity you have had to assess your students' progress. As noted in each of the previous lessons, assessments have gone hand in hand with instruction throughout the curriculum supplement. Whenever individual students expressed themselves by talking, writing, drawing, or performing tasks, you have had an opportunity to assess their thinking and thus their learning. The assessment tasks are embedded within the lessons and offer you the opportunity to:

- determine students' initial understanding of concepts to be learned,
- determine students' initial familiarity with processes and their ability to use them,
- monitor students' conceptual development and ability to use certain processes and skills, and
- collect information about students' achievement of the outcomes of each lesson and of the supplement as a whole.

For example, the *Mouth Journal* is a useful diagnostic and evaluative tool that you can use for assessment. A student's journal is a permanent and continual record of what the student is learning and thinking. By reading the journals regularly, you can identify students who need extra help as well as those who might have special knowledge to share with the class. As a summative evaluation tool, the entries in the journals can be compared with the outcomes for each lesson to see how many of the outcomes are expressed in writing or drawing in the journals. In addition, the journals provide one method of keeping parents and guardians informed of student progress with tangible representations of learning.

The approach to assessment in this supplement is congruent with the following recommendations in the *National Science Education Standards*.[1]

- Assessment tasks are deliberately designed.
- Assessment tasks have explicitly stated purposes.
- Assessment data focus on the science content that is most important for students to learn.
- Assessment tasks are valid and authentic.
- Students have adequate opportunities to demonstrate their achievements.
- Assessment tasks are set in a variety of contexts.
- Assessment tasks include opportunities for students' self-assessment and reflection.

IN ADVANCE

Activities that include the CD-ROM

Activity Number	CD-ROM
Activity 1	optional

Photocopies

Activity Number	Master Number	Number of Copies
Activity 1	Master 6.1, *A Bad Day for Mr. Tooth Template Page*	1 copy for each student
	Master 6.2, *A Bad Day for Mr. Tooth Pictures*	1 copy for each student
	Master 6.3, *A Good Day for Mr. Tooth Template Page*	1 copy for each student
	Master 6.4, *A Good Day for Mr. Tooth Pictures*	1 copy for each student

Materials

Activity 1

For each student:
- 1 copy of Master 6.1, *A Bad Day for Mr. Tooth Template Page*
- 1 copy of Master 6.2, *A Bad Day for Mr. Tooth Pictures*
- 1 copy of Master 6.3, *A Good Day for Mr. Tooth Template Page*
- 1 copy of Master 6.4, *A Good Day for Mr. Tooth Pictures*
- scissors
- glue
- crayons or markers

For teams of 2:
- CD-ROM (optional)
- Computer

Preparation

- Decide if students will complete the activity using the print version or the CD-ROM version.
- If you plan to use the CD-ROM, arrange for students to have access to the computers.
- Duplicate Master 6.1, *A Bad Day for Mr. Tooth Template Page,* 1 for each student.
- Duplicate Master 6.2, *A Bad Day for Mr. Tooth Pictures,* 1 for each student.
- Duplicate Master 6.3, *A Good Day for Mr. Tooth Template Page,* 1 for each student.
- Duplicate Master 6.4, *A Good Day for Mr. Tooth Pictures,* 1 for each student.
- Gather the materials needed for the activity.
- Have students' *Mouth Journals* (prepared in Lesson 1) available for the Wrap-up exercise.

PROCEDURE

Activity 1: Exee Goes Home

The purpose of this activity is to give students the opportunity to express their understanding of the process of tooth decay and the measures that can be taken to prevent dental disease.

1. **Assemble the students in the group area and ask, What do you think happened to Exee?**

   Students will remember that Exee was a visitor to Earth from planet Y. Allow them to discuss what they think visitors to our planet might want to know. Help them recognize that Exee was interested in information to bring back to his planet. He was particularly curious about mouths, since he did not have one.

2. **Tell the students that Exee decided to return to planet Y after learning all about the mouth and what happened inside it. Then, read to them a story about Exee's return to planet Y.**

Home at Last

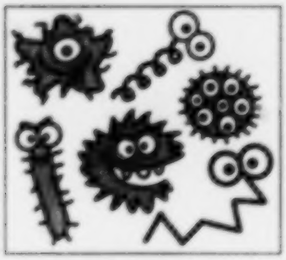
"Wow!" thought Exee. "What a neat planet Earth is. I loved all the different places I discovered, jungles and waterfalls, deserts and mountains, oceans and puddles. But, my favorite places were the little ones, like the places between human toes, and behind human ears, and inside human mouths. I can't wait to tell my friends on planet Y all about these new and different places."

So, Exee flew back to planet Y, going miles and miles across space. When Exee landed, all friends gathered for the homecoming. They were excited to see that Exee was safe and was home again after being gone such a long time. They also wanted to hear about all the new and different things on planet Earth.

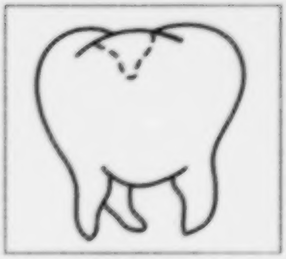
Exee began telling them. He described everything so well that they could picture in their minds the tall mountains. They could almost hear the rushing water of the waterfalls. They believed they could feel the hot sun in the desert. But the mouth? Now, that was hard to imagine.

Exee's friends were very confused. Exee needed pictures to help him describe what the mouth was like and what happened inside it. He pulled out his photo album of the trip and opened it up. Suddenly, a burst of wind on planet Y blew all his photos onto the ground in a jumbled mess. Exee needed help!

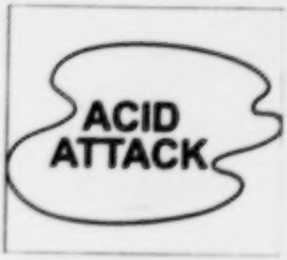
3. **Ask the students if they think they could help Exee put his pictures back in order. Ask students to return to their desks, then distribute one copy of both Master 6.1, *A Bad Day for Mr. Tooth Template Page,* and Master 6.2, *A Bad Day for Mr. Tooth Pictures,* to each student. Review each picture with the students so they understand the illustrations.**



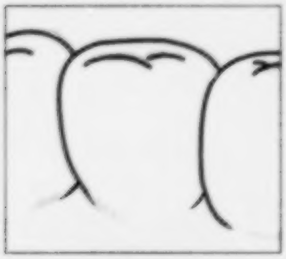
Bacteria



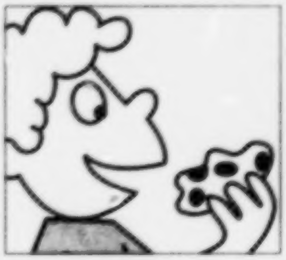
White spot



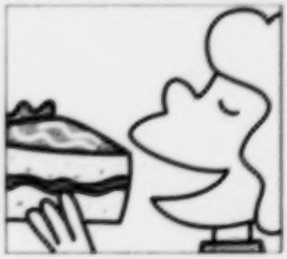
Acid attack



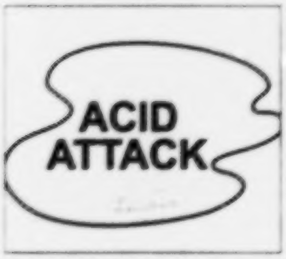
Plaque



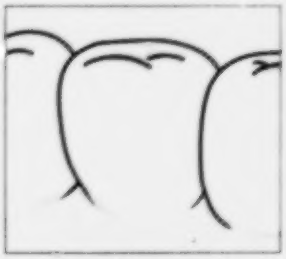
Eating



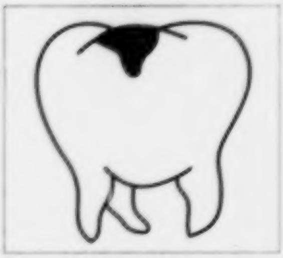
Eating



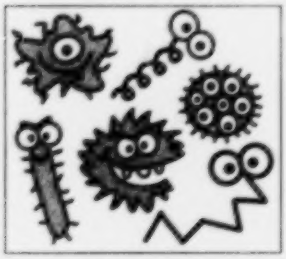
Acid attack



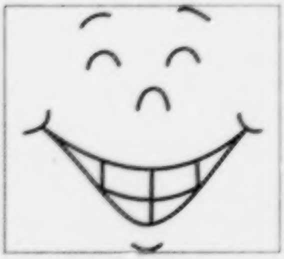
Plaque



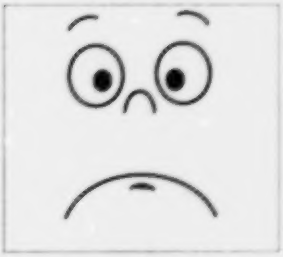
Cavity



Bacteria



Happy face

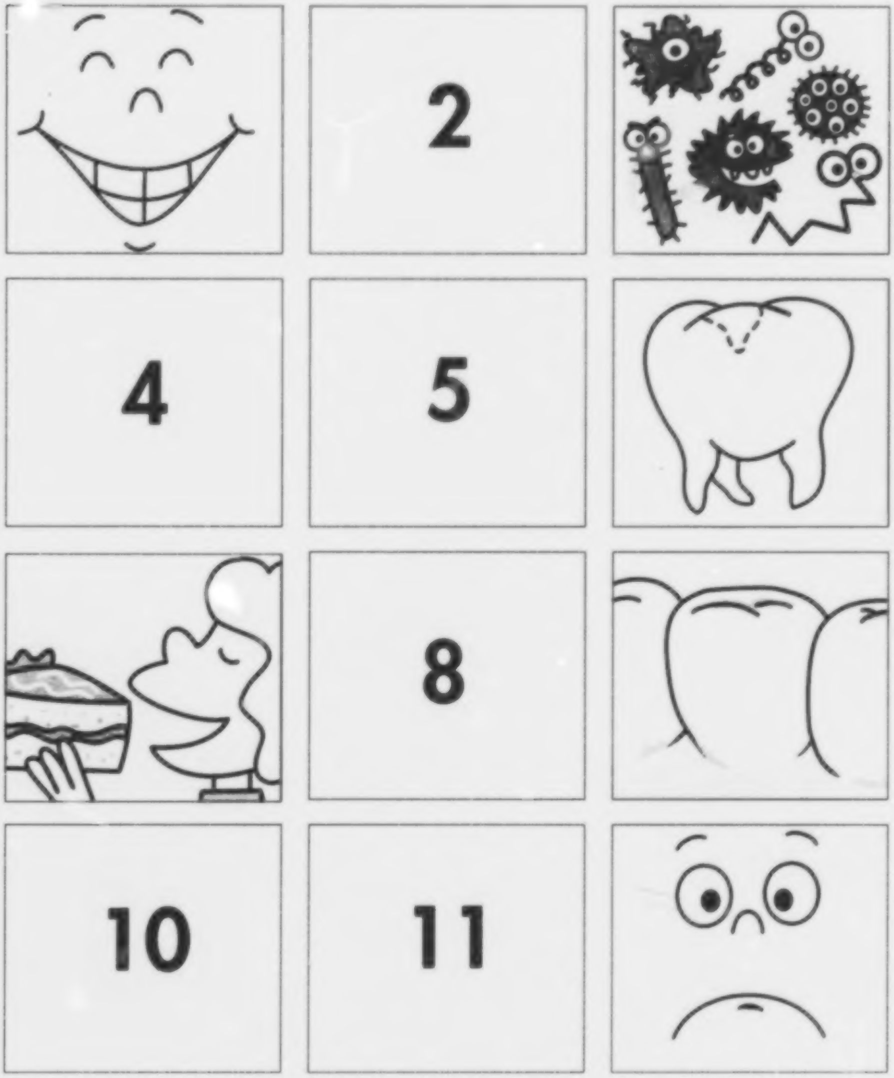


Sad face

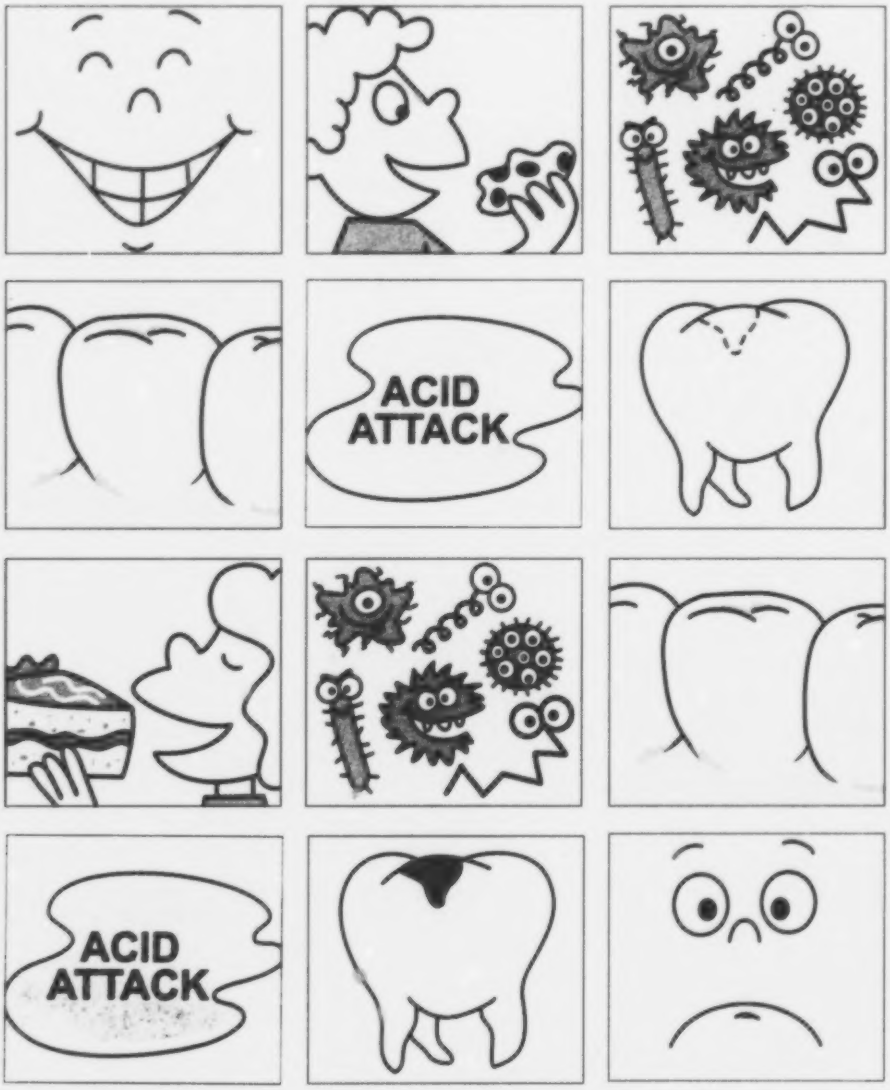
4. **Direct students to cut out the pictures so that they will be just like those that Exee needed to put in order.**

5. **Once students have cut out their pictures, tell them that these were the pictures Exee had taken of a bad day in the life of Mr. Tooth. Ask students to put the pictures in order so that Exee can use them to describe what can happen in a human mouth.**

If sequencing all the pictures is too difficult for the students, help them by telling them which pictures go in certain places. Start them out by telling the students that the picture of the happy face goes in box 1 on the template page. The picture of bacteria belongs in box 3, the white spot in box 6, and plaque in box 9, as shown in the following illustration. Mr. Tooth is sad at the end, as shown in box 12.



Then have students work independently to put the remaining pictures in order. The solution is shown in the following illustration.



Circulate around the room so that you can see how students are doing with the task. Offer encouragement and ask questions to help students who might be struggling, such as these:

- What do you think happened last to Mr. Tooth? (He decayed.)
- What do you think caused Mr. Tooth to decay?
- How can you use the pictures in the middle to describe how he decayed?
- (See additional questions in *Background Information: The Evaluate Lesson.*)

NSES

Content Standard A: Abilities necessary to do scientific inquiry.

Students should be able to tell you why they placed each picture in the order that they did. You should expect to hear that, in the beginning, the mouth was healthy with all teeth intact. Then, the mouth ate lots of sugary and starchy foods. The bacteria in the mouth were nourished by the sugar and multiplied. When they ate and multiplied, they also left behind waste products: acids. After some time, the acids caused a white spot on the tooth where they dissolved some of the enamel. Then, the acids continued to eat away the enamel until the tooth got a cavity.

6. **Instruct students to glue their final sequence on Master 6.1, *A Bad Day for Mr. Tooth Template Page*.**

7. **When all the students have completed their sequence and you have circulated around to see that all students understand their sequence and can describe it accurately to you, continue with the story:**

Home at Last (continued)

Exee finally got all his pictures in order. As he was describing what happened inside the mouth, some of his friends started to cry.

"Why are you crying?" asked Exee.

"The story about Mr. Tooth is so sad!" cried his friends. "Mr. Tooth is gone, destroyed, kaput!"

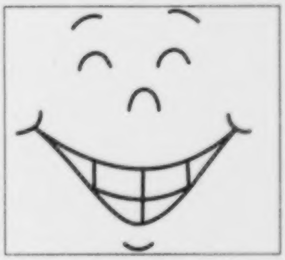
"Wait a minute, everybody," said Exee. "I have shown you pictures only of Mr. Tooth's bad day. The story doesn't have to end like that. Here, let me show you some new pictures."

Exee's friends gathered around him, and soon they were laughing and chattering away happily. They weren't worried about poor Mr. Tooth anymore.

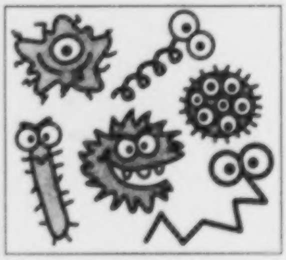
8. **Ask students, What pictures do you think Exee showed his friends? What things could Exee tell his friends that would make Mr. Tooth's bad day much better?**

   Hold a brainstorming session with your students about the things they know would make Mr. Tooth not have such a bad day (not have tooth decay). Students might mention brushing, flossing, avoiding sweets, visiting the dentist, not snacking often, and so on.

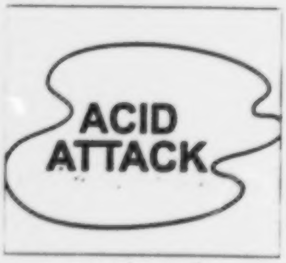
9. **Distribute one copy of both Master 6.3, *A Good Day for Mr. Tooth Template Page* and Master 6.4, *A Good Day for Mr. Tooth Pictures*, to each student. Review and describe what is going on in each of the pictures on the page.**



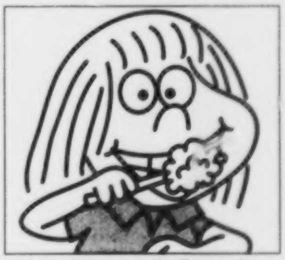
Happy face



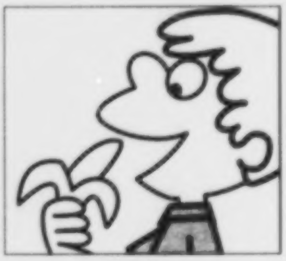
Bacteria



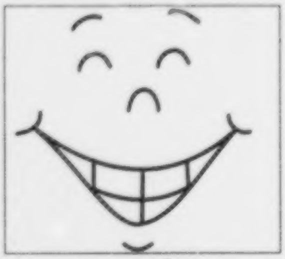
Acid attack



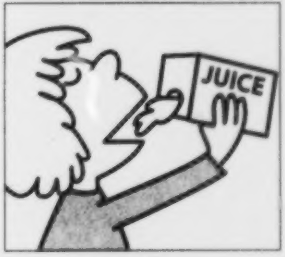
Brushing with fluoride toothpaste



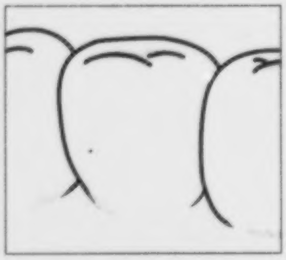
Eating



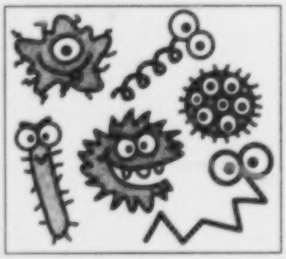
Happy face



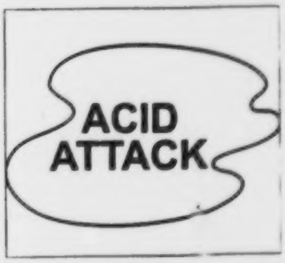
Drinking



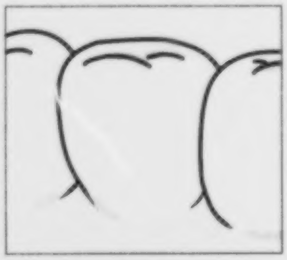
Plaque



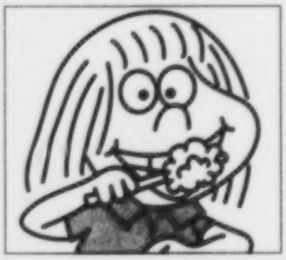
Bacteria



Acid attack



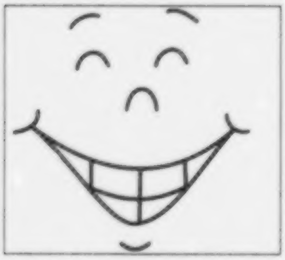
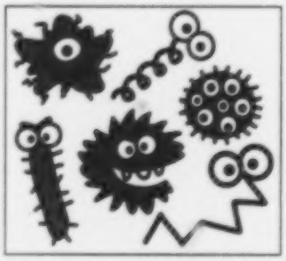
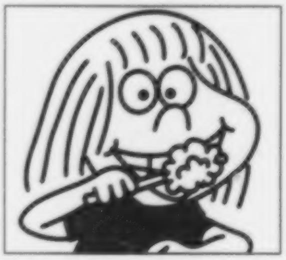
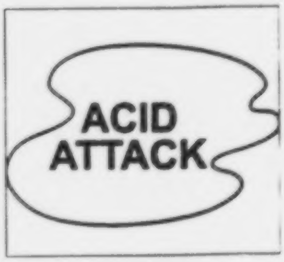
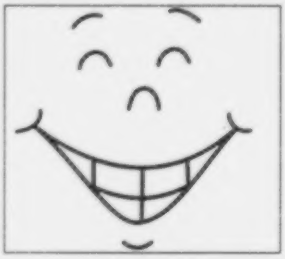
Plaque



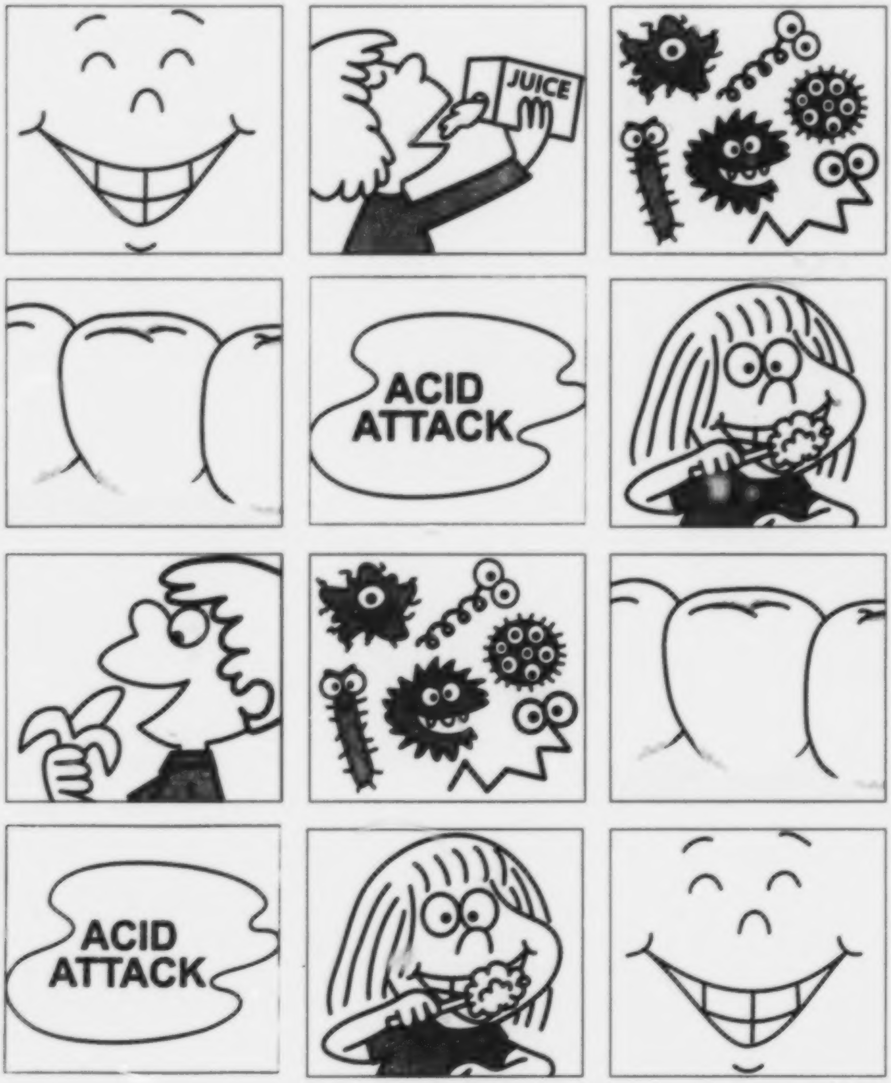
Brushing with fluoride toothpaste

10. **Ask students if they think they can sequence the pictures to make Exee's friends much happier. Direct students to use these pictures to put together a story called *"A Good Day for Mr. Tooth."***

    As before, circulate around the room so that you can evaluate how the students are doing with the task. If the sequencing is too difficult for the students, help them get started by telling them where certain pictures belong in the sequence. The following illustration suggests which pictures to use for prompting the students.

	2	
4	5	
7	8	9
 ACID ATTACK	11	

The solution to the sequencing activity is shown in the following illustration.



11. **At this time, an individual interview with each student would be optimal. Ask each student to show you his or her sequences and tell you why he or she chose the pictures in that order.**

If necessary, manipulate some of the pictures and ask the student to tell you why the new order was better for Mr. Tooth or not as good for Mr. Tooth. In this way, you can probe for understanding of some of the science concepts that underlie the reasons for things like brushing after meals, avoiding sugary and starchy foods, and limiting between-meal snacks. Once the student has determined a sequence, have him or her glue the pictures onto Master 6.3, *A Good Day for Mr. Tooth Template Page,* for a permanent record.

NSES

Content Standard A: Abilities necessary for scientific inquiry.
Content Standard F: Personal health.

Alternately, if time does not allow you to interview each student, ask students to glue their final sequence onto Master 6.3, *A Good Day for Mr. Tooth Template Page*. Collect the sequences and assess them for how well they display understanding. If you see a sequence that confuses you or does not accurately portray a good day for Mr. Tooth, you can interview the student who did the work and check if he or she understands the concepts of tooth decay and cavity prevention.

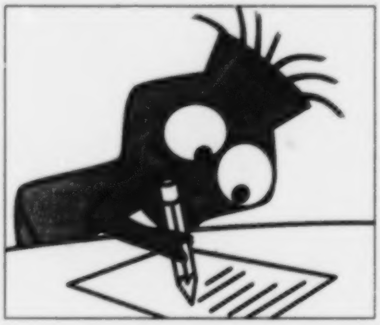
12. **Invite the students to continue putting Exee's pictures in sequence using the activity on the CD-ROM. Instruct students to work in pairs on the activity.**

From the main menu, select *Exee Says Good-bye.*

Encourage pairs of students to collaborate on their sequence and then submit it for evaluation by the computer. In this way, you will be encouraging continued dialogue about the processes that take place in the mouth that lead to either poor or good oral health.

13. **Congratulate the class on a job well done.**

Wrap-up



Ask students to complete their journals. Encourage them to write about their own ideas and what they thought was important and most interesting about the six lessons in this supplement. Remind them that they can write about their thoughts, ideas, and feelings about science and what they learned about oral health as well as facts about the mouth.

Assessment:
Help students decide when their journals are complete, but don't expect a finished, edited product. To promote writing, allow students to be creative and take risks with their writing. Read each student's journal and respond to the quality of thinking and observing.

Encourage students to share what they have written or drawn in their journals with their classmates. Some students will always be eager to read aloud from their journals, but encourage all students to read aloud at some point. Sharing is important because it permits students to learn by example, boosts self-esteem, provides a chance for students to reflect on what they learned, encourages students to compare their ideas with others, and gives the teacher the chance to elaborate on concepts in which students are interested or with which students are having difficulty.

Additional Resources for Teachers

The following sites on the World Wide Web may provide additional background information for you and your students about the mouth, teeth, and oral hygiene practices.

National Institute of Dental and Craniofacial Research
http://www.nidcr.nih.gov

The National Institute of Dental and Craniofacial Research (NIDCR) supports research to diagnose, prevent, and treat oral health diseases and disorders. The site provides current information about oral, dental, and craniofacial health.

Office of Science Education (OSE)
http://science-education.nih.gov

This address takes you directly to the home page of the National Institutes of Health's Office of Science Education. This site provides access to a variety of resources for teachers and students, including NIH publications.

American Dental Association Online
http://www.ada.org/

This site includes information for patients, the public, and dental professionals. The ADA is the professional association of dentists.

Centers for Disease Control and Prevention (CDC) – Oral Health Division
http://www.cdc.gov/nccdphp/oh/

This site promotes health and quality of life by promoting oral health. This site contains information to promote health and includes information on infection control, oral cancer, children's oral health, water fluoridation, and educational materials.

Colgate–Palmolive
http://www.colgate.com/

This site provides information for the public and professional world of dental health. The site reviews its products. Colgate's Web site also has activities and stories for children located by clicking on *Kidsworld.*

Crest Toothpaste
http://www.cresttoothpaste.com/

This site includes a product guide, professional resources, and a family care center. Students can access a fun interactive site called *Sparkle City.*

Oral-B Care Center
http://www.oralb.com

This site provides information on oral health care for patients, public and dental professionals. Children can receive information on oral health by accessing the *Brush Buddies Adventure* page.

The American Dental Hygienists' Association (ADHA Online)
http://www.adha.org

This site provides information for the dental professional as well as the public. The site includes information on oral health, oral health careers, professional issues, and an interactive and informative site for children.

Bright Futures
http://www.brightfutures.org

This site is designed for healthcare professionals, educators, child care providers, and families. It provides information and guidelines to promote oral health and prevent oral diseases.

Glossary

baby bottle tooth decay: Also known as severe early childhood caries. A severe pattern of dental caries in infants and young children that first attacks the upper front teeth.

bacillus: A bacterium that has a straight rod-like shape.

bacteria: A group of one-celled microorganisms that are mostly disease-producing.

bicuspid (premolar): One of the two permanent teeth located in front of the molars and behind each cuspid. These teeth have two cusps (points) and are used to tear and grind food.

bolus: A chewed, soft mass of food.

buffer: A substance that helps regulate or stabilize the pH of a solution during chemical reactions.

carbohydrate: A main source of energy for our body that is composed of starches and sugars. Carbohydrates are found predominantly in breads, cereals, fruits, and vegetables.

caries (dental caries): The bacterial disease known as tooth decay or cavities that causes demineralization of teeth through frequent exposure to sugars and starches.

cavity (carious lesion): An area of the tooth affected by dental caries.

cementum: A layer of bone-like mineralized tissue that covers the roots of a tooth.

cleft lip and/or palate: A malformation present at birth where the lip or palate fails to fuse. A cleft lip and /or palate require surgical correction.

coccus: A bacterium that is spherical in shape.

control: Person(s) or object in an experiment selected to be like the experimental subject except for the variable being tested.

craniofacial: That which is involved or related to the skull and the face.

crown: The part of the tooth covered with enamel and protruding above the gum line.

cuspid (canine): A sharp, pointed tooth used for tearing food; located between the first bicuspid and the lateral incisor.

deciduous teeth: See *primary teeth.*

demineralization: Process of mineral loss from the enamel during the early stages of dental caries. The mineral loss results in chalky white or opaque patches on the tooth surface.

dentin: A tissue, hard and bone-like, that forms most of the tooth.

dextran: An oral bacteria waste product that is sticky and adheres to the tooth, creating a film called plaque.

digestive enzymes: Enzymes that speed the process of breaking large food molecules into smaller units that are absorbed into the cells.

enamel: The visible outer layer of the tooth.

environment: Everything in the surroundings of an organism; living and nonliving surroundings and factors including light, temperature, air, soil, water, and organisms.

enzyme: A catalyst produced by an organism and used to speed up a specific kind of chemical reaction.

esophagus: The tubular portion of the digestive tract that leads from the pharynx to the stomach.

facial nerve (cranial nerve VII): Nerve that supplies sensory and parasympathetic fibers to the tongue, palate, and the narrow passage from the mouth, and motor fibers to the muscles of the face and jaw.

fluoride: A mineral that is effective in preventing and reversing the early signs of dental caries. Fluoride occurs naturally and contains the element fluorine.

frenulum: A small fold of tissue that connects a more fixed part, such as the floor of the mouth, to a movable part, like the tongue.

fructose: Known as fruit sugar; a member of the simple sugars carbohydrate group found in fruits, honey and syrups, and certain vegetables.

gingiva (gums): The tissue that surrounds the neck of the tooth and covers the alveolar bone.

gingivitis: Gum inflammation caused by the buildup of plaque along the gum line.

glucose: A member of the simple sugar carbohydrate group that is found in fruits and honey. Glucose is the most common free sugar that circulates in the blood of higher animals.

incisor: One of the four front teeth on the upper and lower jaw.

malocclusion: Teeth that are misaligned or fit together poorly when the jaws are closed.

mamelon: A small bump on the biting surface of an incisor tooth when it first appears in the mouth. Normal chewing and biting usually wear down mamelons to leave a smooth tooth edge.

microorganism: An organism too small to be seen with the unaided eye, such as bacteria, viruses, unicellular algae, and protozoans.

model: Something that is used as the foundation for a similar idea or process.

molar: A tooth located in the back of the mouth used for crushing and grinding food. There are usually three permanent molars on each side of the jaws. There are two primary molars on each side of the jaw.

mumps: A viral infection that causes the salivary glands, especially the parotid gland, to swell.

olfactory system: Anything connected with or relating to the sense of smell.

oral cavity: The inside of the mouth, bounded by the palate, teeth, and tongue.

oral hygiene: Activities that promote good health of the mouth.

palate: The roof of the mouth; the partition between the oral and nasal cavities that is formed by the hard palate and the soft palate.

papilla: One of the small bumps on the upper surface of the tongue. (papilla, singular; papillae, plural)

permanent teeth: The second and final set of teeth to appear in the mouth, consisting of 32 teeth.

pH scale: A scale from 0 to 14 reflecting the concentration of hydrogen ions in solution; the lower numbers denote acidic conditions and the upper numbers denote basic, or alkaline, conditions.

pharynx: The area where the air and food passages cross; found in the throat of vertebrates.

pits and fissures: Dimples (pits) and creases (fissures) found on six- and twelve-year molars, and premolar teeth. Pits also may be found on the back surfaces of upper front teeth.

plaque: A sticky, thin film that is made up of a protein substance and microorganisms that adhere to the tooth.

prediction: To foresee using observation, experience, or scientific reason.

primary teeth: The first set of teeth. This set of 20 teeth is also known as baby, deciduous, or milk teeth.

pulp chamber: The tooth's innermost part containing blood vessels, cells, and nerves.

remineralization: The reversal of demineralization of tooth enamel.

root: The part of the tooth that anchors it to the bone and is normally beneath the gum.

saliva: The watery liquid secreted into the mouth from the salivary glands.

salivary gland: An organ that secretes saliva.

scientific inquiry: The process by which scientists ask questions, develop and carry out investigations, make predictions, gather evidence, and propose explanations.

sealants: Thin coatings made of plastic applied to the chewing surfaces of back teeth to prevent decay.

sensory organs: Organs that are capable of receiving and responding to outside information (stimulus).

six-year molars: The first permanent molar teeth to come into the mouth.

speech pathologist: A person who studies the irregularities of speech.

starch: A complex carbohydrate made up of many glucose molecules linked together and found in foods like potatoes, wheat, rice, and corn.

sucrose: Also known as white or table sugar. Sucrose is made up of two simple sugar units: glucose and fructose. Sucrose occurs naturally in many green plants as a product of photosynthesis.

taste bud: A sense organ found primarily on the tongue's upper surface consisting of small flask-shaped groups of cells.

tongue: Movable organ on the floor of the mouth.

tooth decay: See *caries*.

uvula: The fleshy structure hanging from the center of the soft palate.

waste product: A byproduct (such as urine or feces) that is discharged from a living body.

white spot: A chalky or opaque patch on the tooth surface resulting from early loss of minerals from the tooth enamel. White spots can be precursors to cavities if proper oral hygiene and diet are not followed.

wisdom tooth: The third molar found in each jaw.

x-ray: A photograph that reveals details not normally visible.

References

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Lesson 2, *Open Wide! What's Inside?*

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Lesson 3, *Let's Investigate Tooth Decay!*

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Lesson 4, *What Lives Inside Your Mouth?*

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Lesson 5, *What Keeps Your Mouth Healthy?*

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Lesson 6, *What Have You Learned About the Mouth?*

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Masters

Lesson 1, *What Do Mouths Do?*

Master 1.1, *A Visitor from Outer Space*	teacher copies
Master 1.2, *Mouth Journal*	student copies
Master 1.3, *Mouth Journal Writing Pages*	student copies

Lesson 2, *Open Wide! What's Inside?*

Master 2.1, *The Parts of the Mouth*	transparency
Master 2.2, *Mouth X-Ray*	original
Master 2.3, *Take-home Activity 1: My Tooth Record*	student copies
Master 2.4, *The Parts of My Mouth Game Cards*	student copies

Lesson 3, *Let's Investigate Tooth Decay!*

Master 3.1, *Apple Record Page*	student copies
Master 3.2, *Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!*	student copies

Lesson 4, *What Lives Inside Your Mouth?*

Master 4.1, *Animals Do More Than Eat and Drink*	teacher storybook

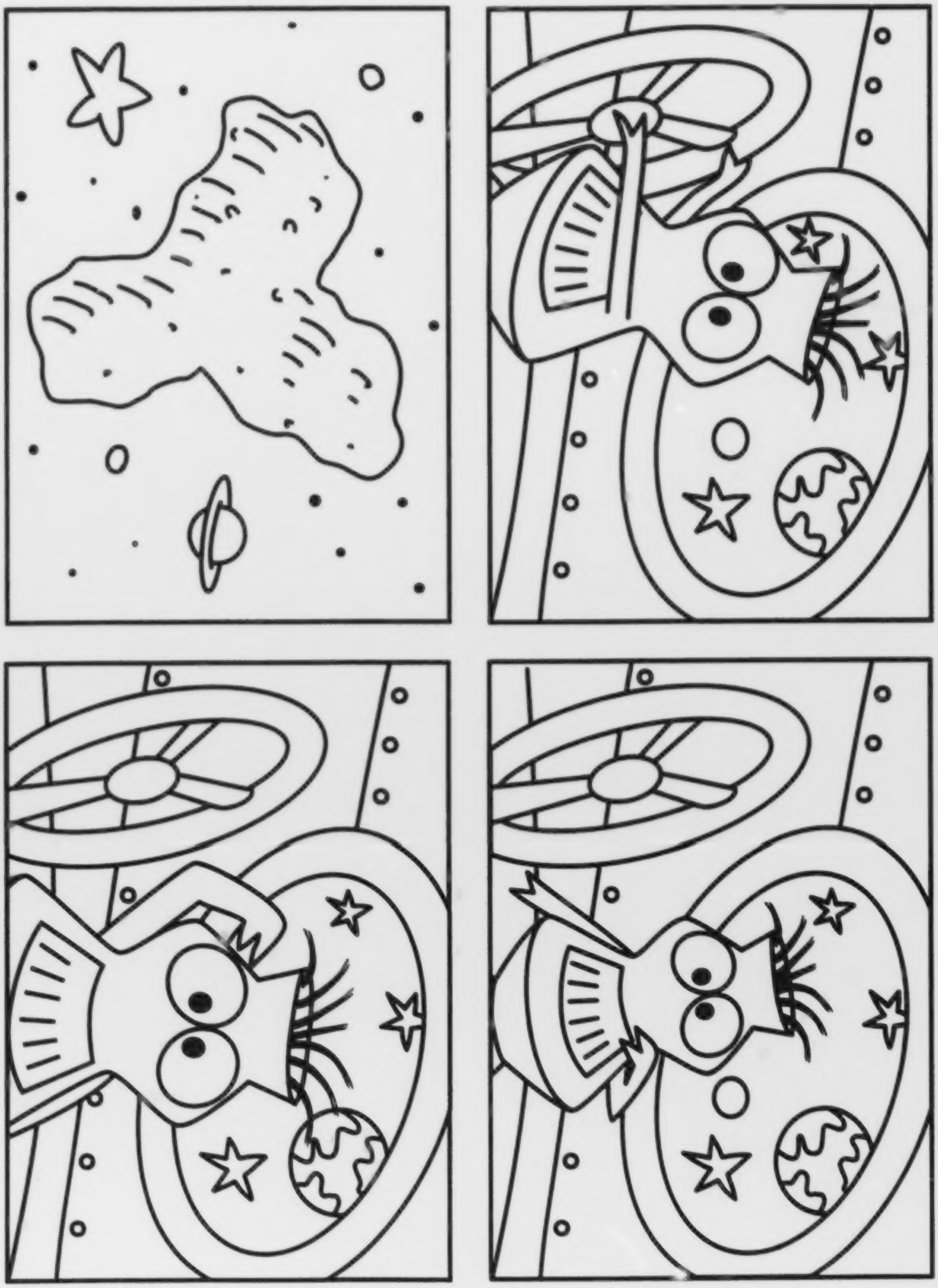
Lesson 5, *What Keeps Your Mouth Healthy?*

Master 5.1, *Take-home Activity 3: Brushing to the Beat!*	student copies

Lesson 6, *What Have You Learned about the Mouth?*

Master 6.1, *A Bad Day for Mr. Tooth Template Page*	student copies
Master 6.2, *A Bad Day for Mr. Tooth Pictures*	student copies
Master 6.3, *A Good Day for Mr. Tooth Template Page*	student copies
Master 6.4, *A Good Day for Mr. Tooth Pictures*	student copies

A Visitor from Outer Space



Master 1.1a

Master 1.1b

Picture 1: Hi! Welcome to my spaceship.

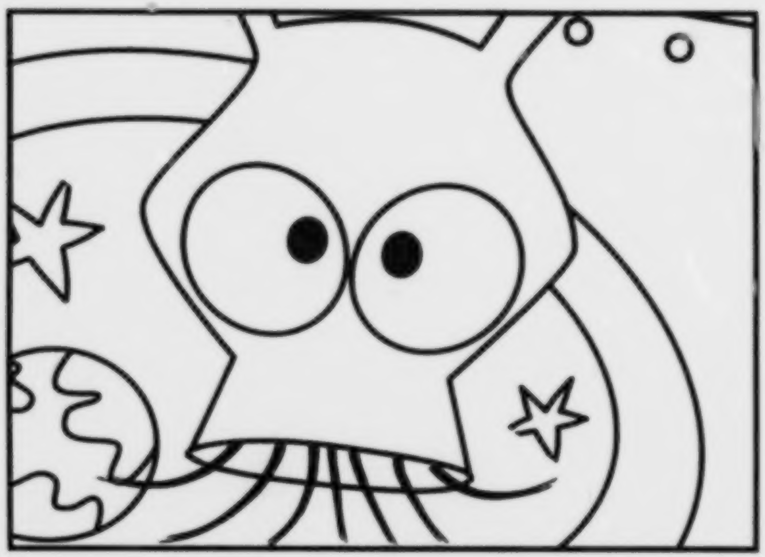
Picture 2: My name is Exee, and I'm

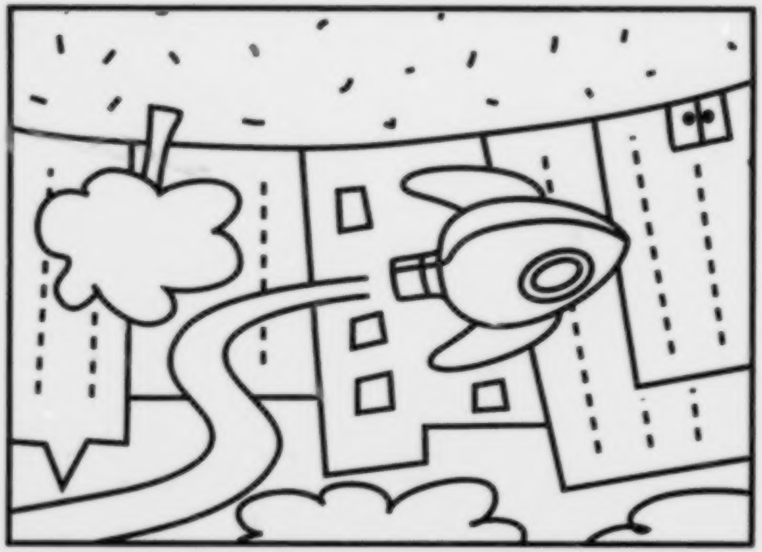
Picture 3: from planet Y. We call it Y because

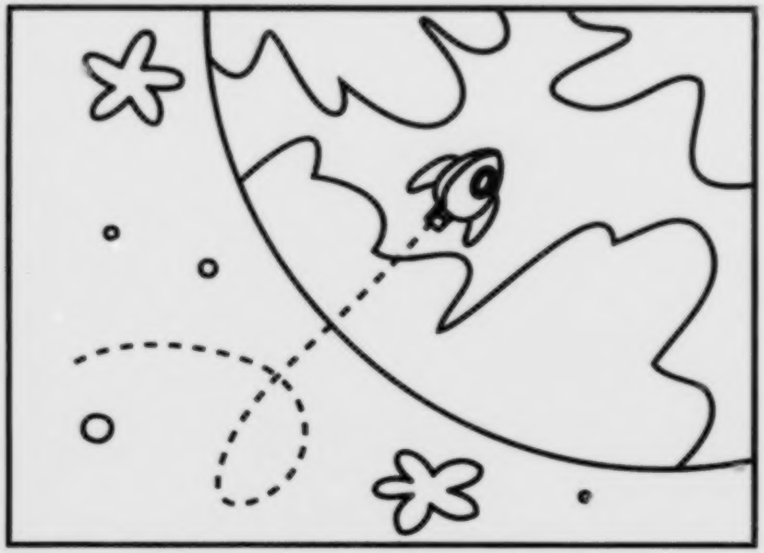
Picture 4: we like to know why. (Taps head.)

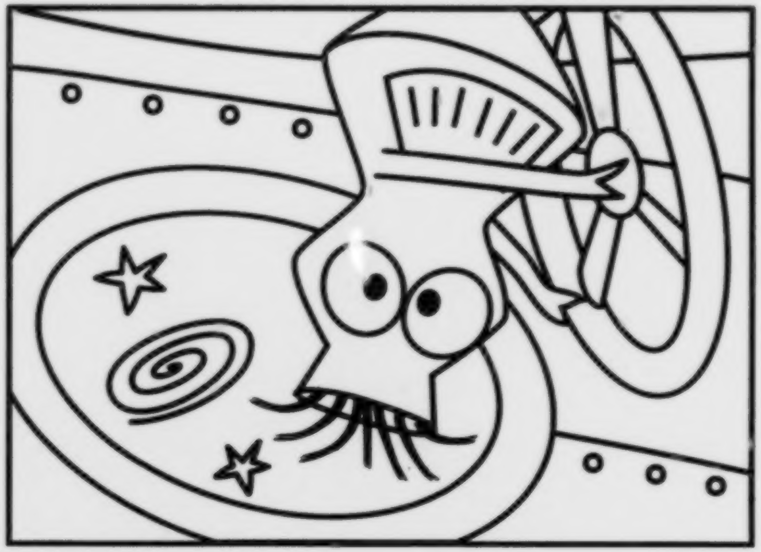
(page 1)

Master 1.1c









Master 1.1d

Picture 1: Right now I'm on my way to visit

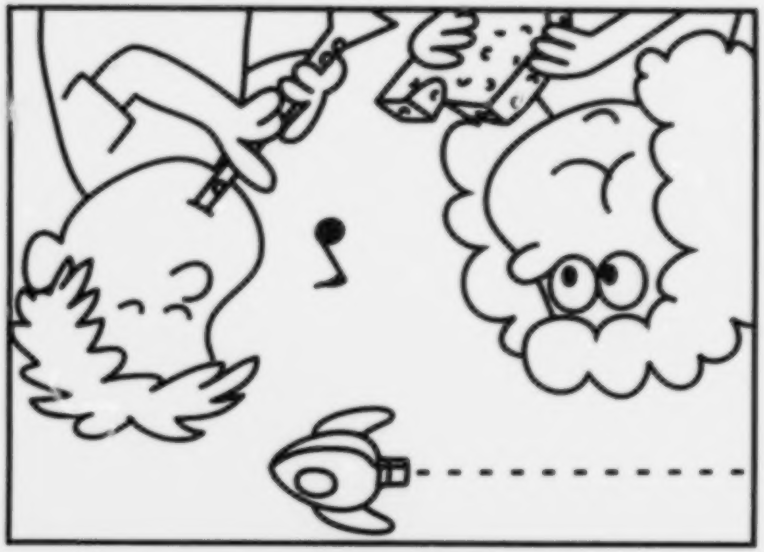
Picture 2: the Earth to have a look around.

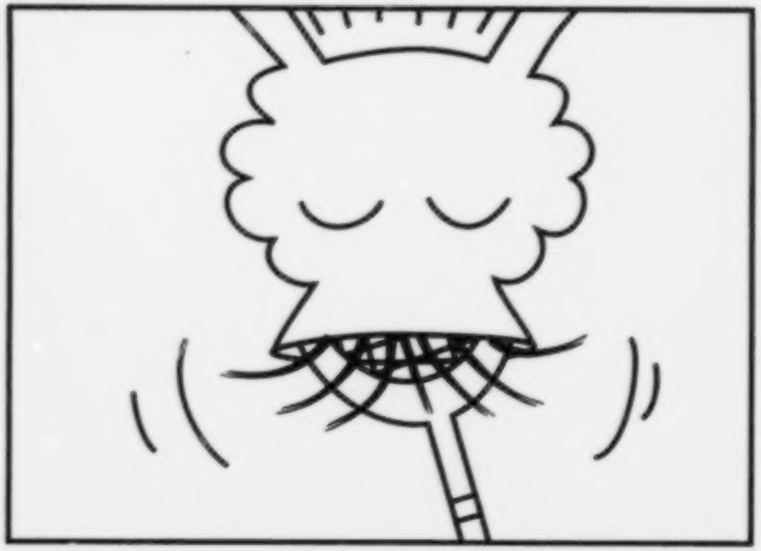
Picture 3: (Zooms through.)

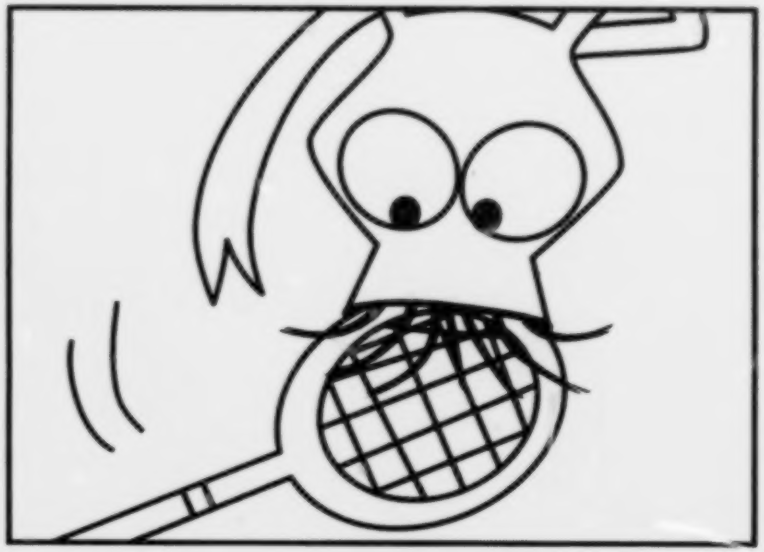
Picture 4: I always have three rules:

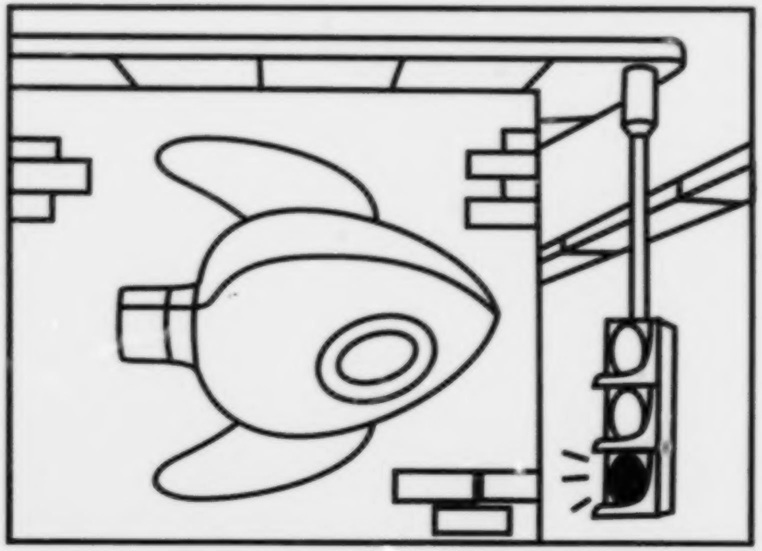
(page 2)

Master 1.1e









Master 1.1f

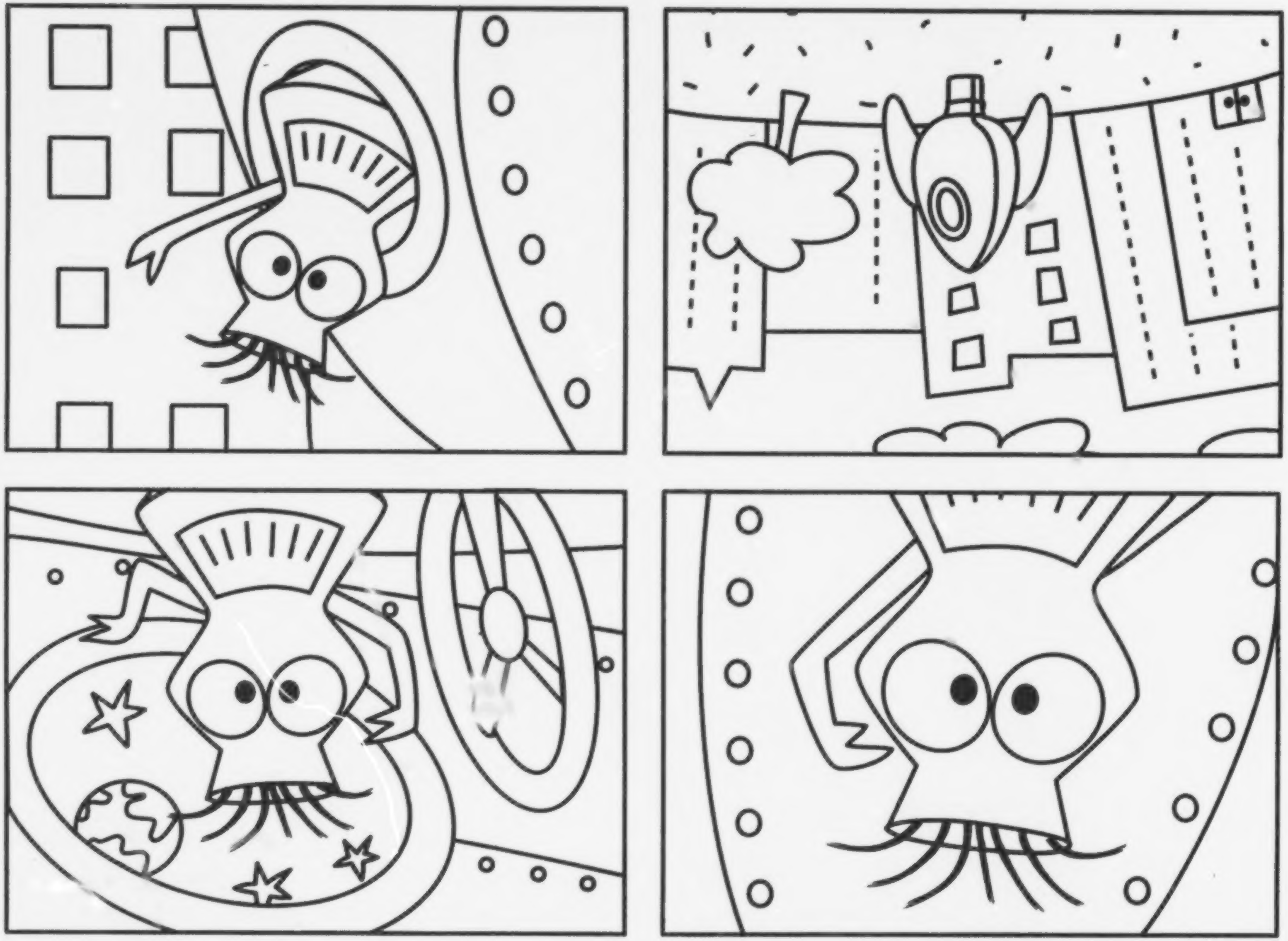
Picture 1: Obey local regulations. (Screeches to a halt at a red light.)

Picture 2: Eat the local food.

Picture 3: Mmm. A bit chewy!

Picture 4: (Zips through as kids eat and play instruments.)

Master 1.1g



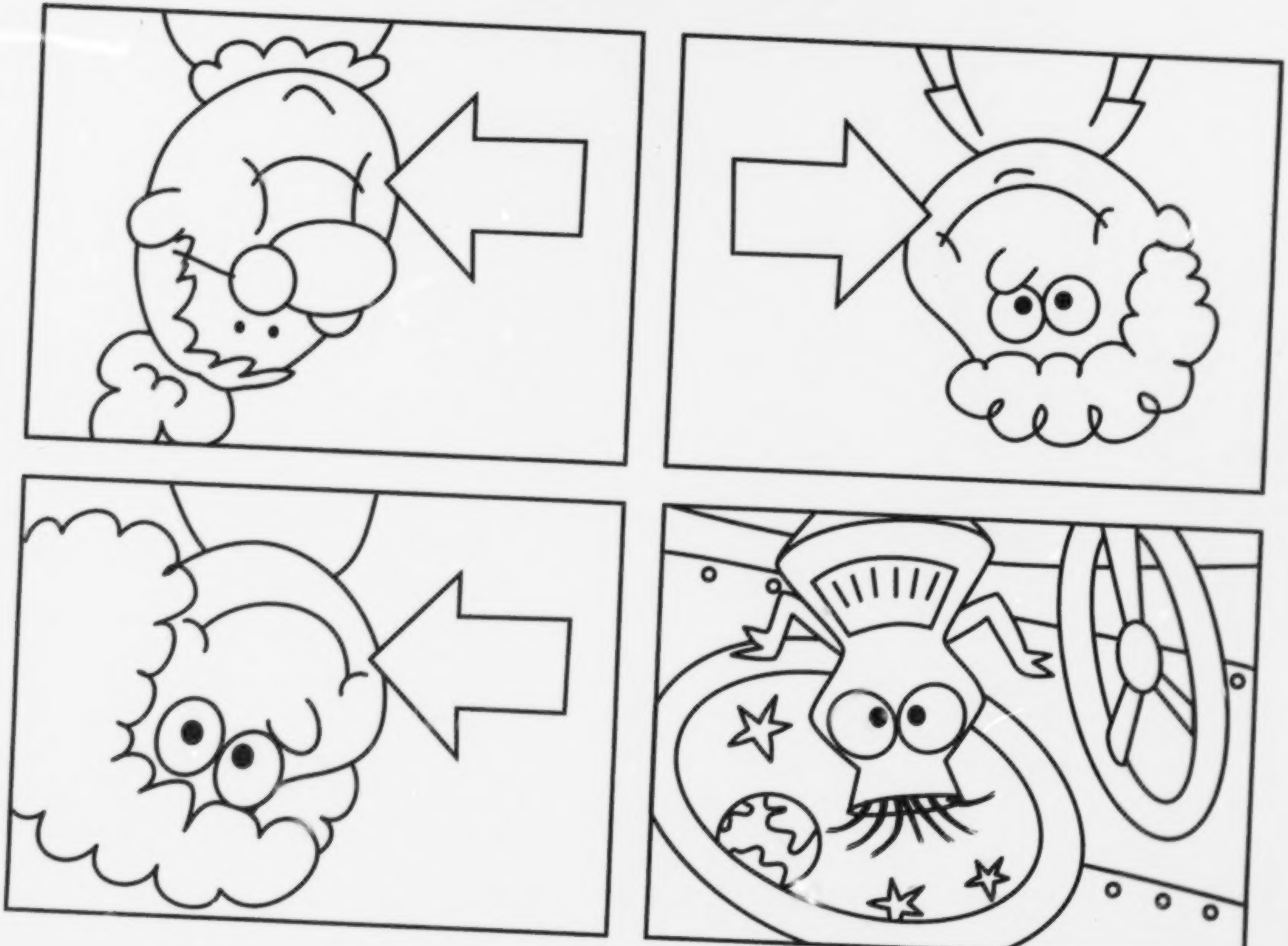
Picture 1: And the most important rule is to ask a lot of questions.

Picture 2: And, boy, have I got questions!

Picture 3: (Zooms in and lands.)

Picture 4: Come on in!

Master 1.1i



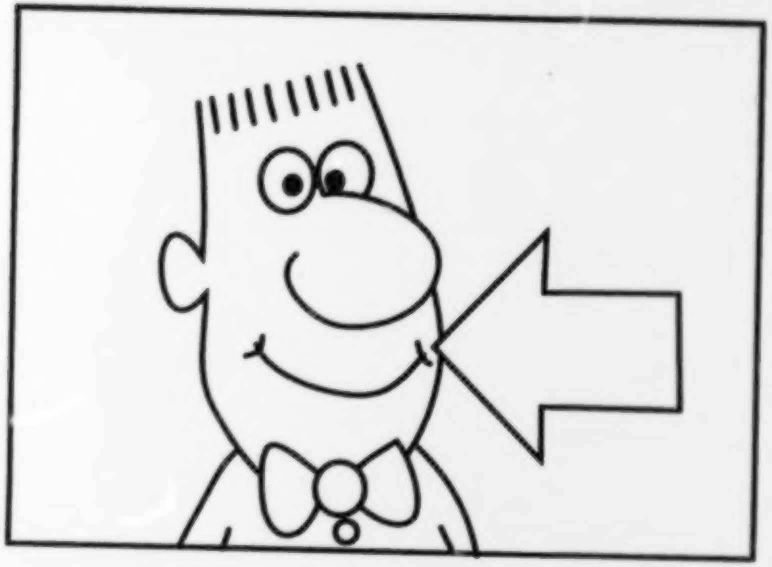
Master 1.1j

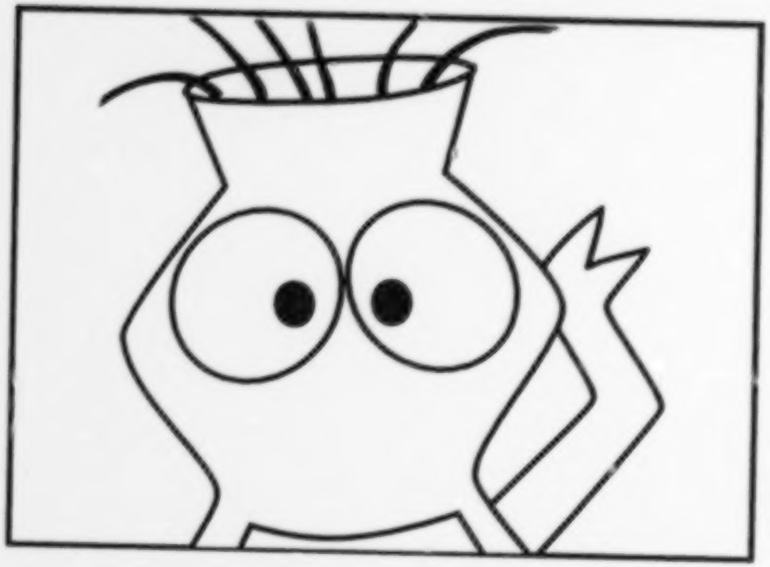
Picture 1: Now, I don't want to be rude or anything, but why do you Earth people have

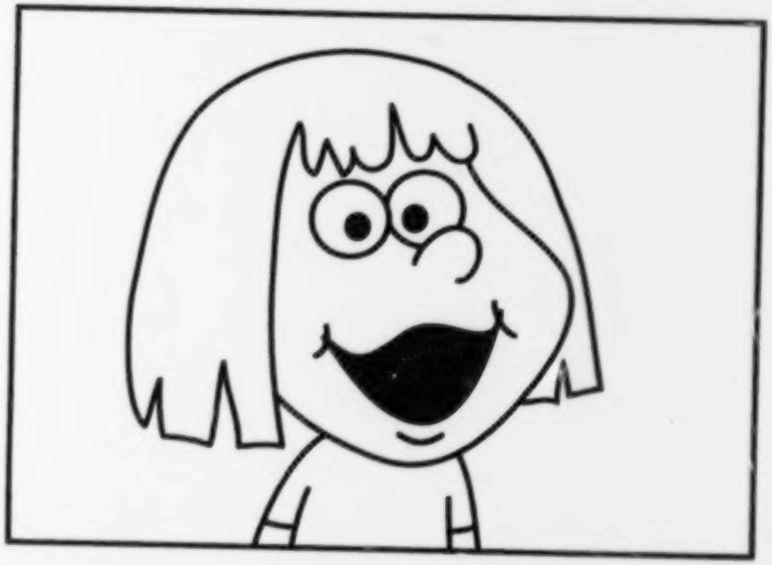
Picture 2: that hole in the middle of your faces?

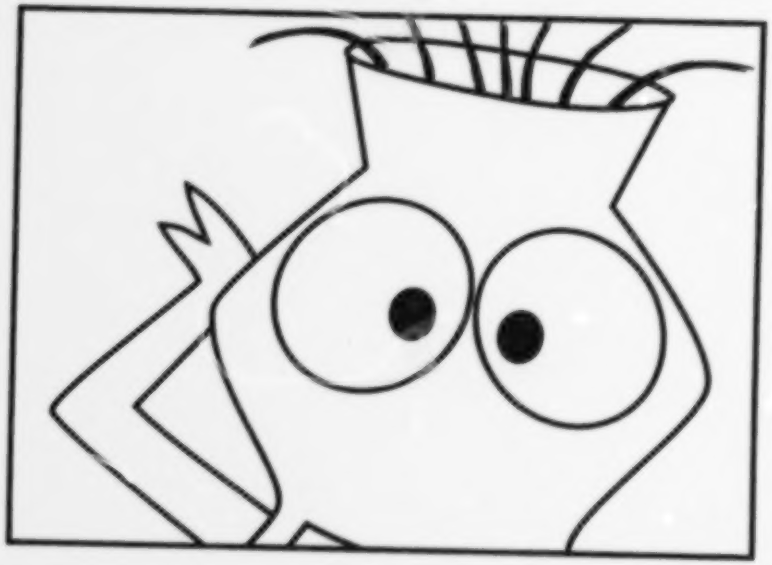
Picture 3: I've never seen anything like it.

Picture 4: You all seem to have one.









Master 1.1k

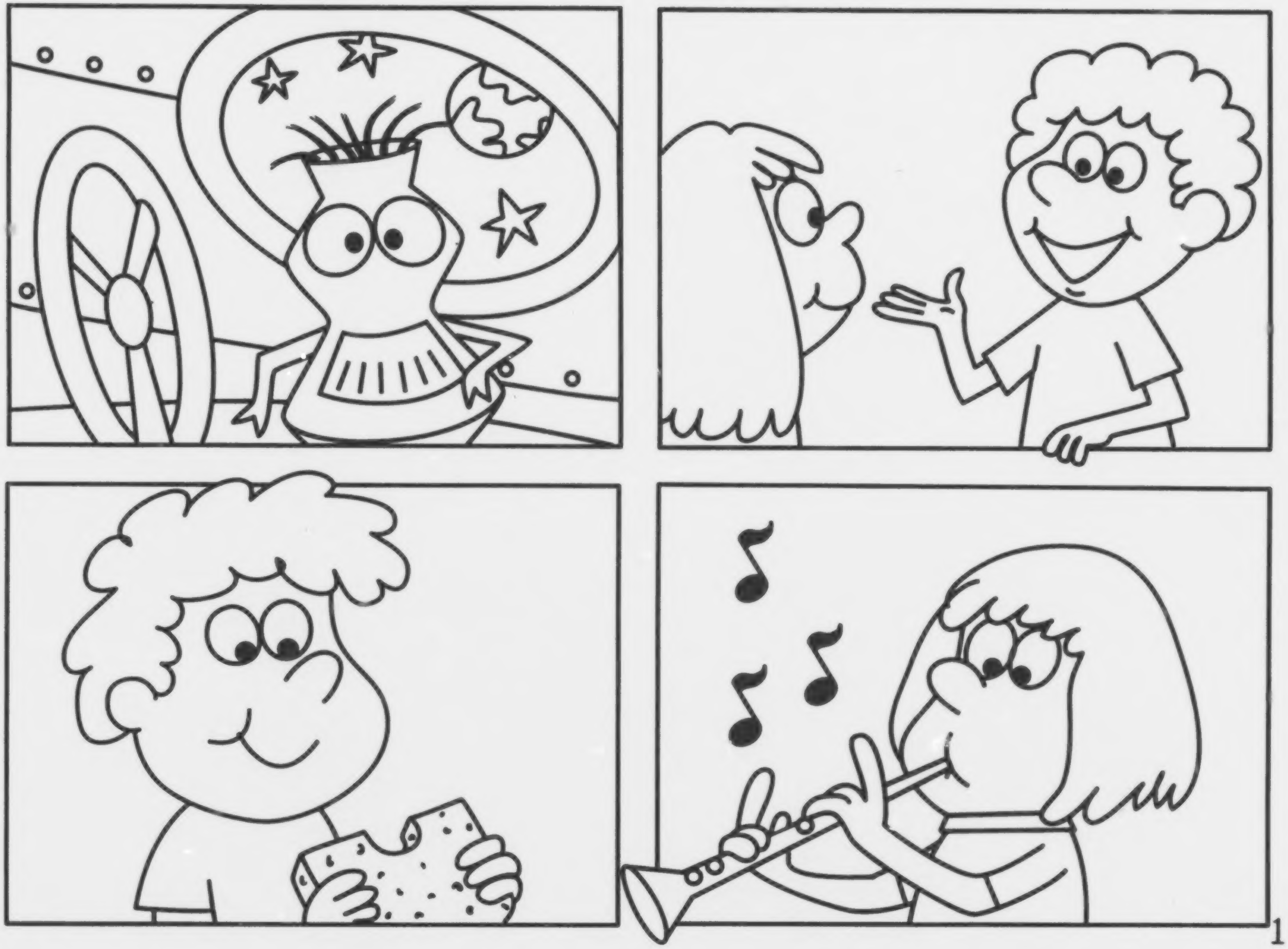
Master 1.11

Picture 1: What's it called, anyway?

Picture 2: A **mouth**?

Picture 3: Oh, ouch!

Picture 4: Doesn't it hurt when you open it?



Master 1.1m

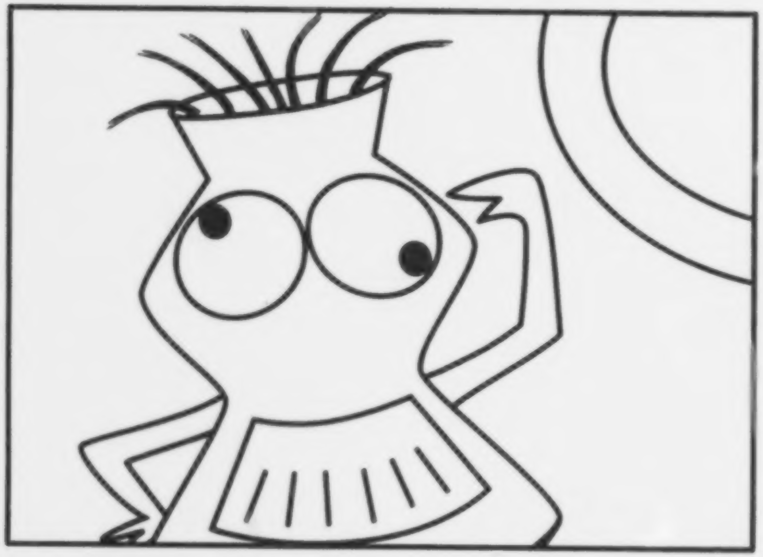
Master 1.1n

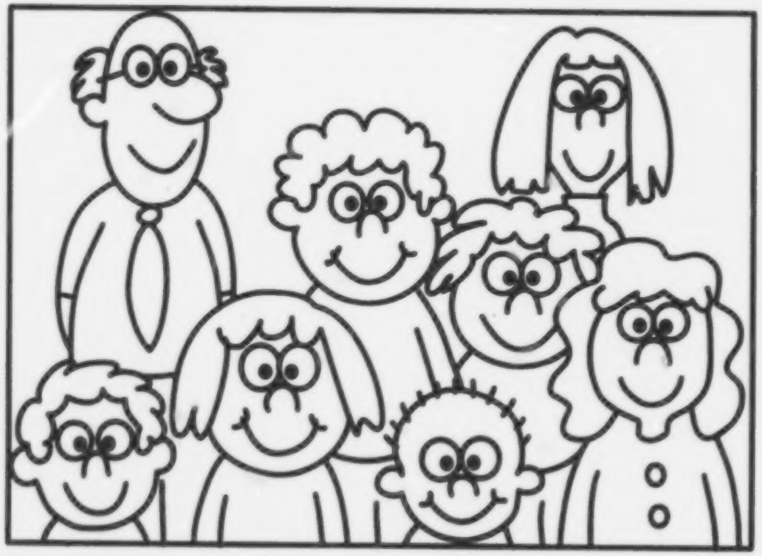
Picture 1: **What**? You use your mouth to talk?

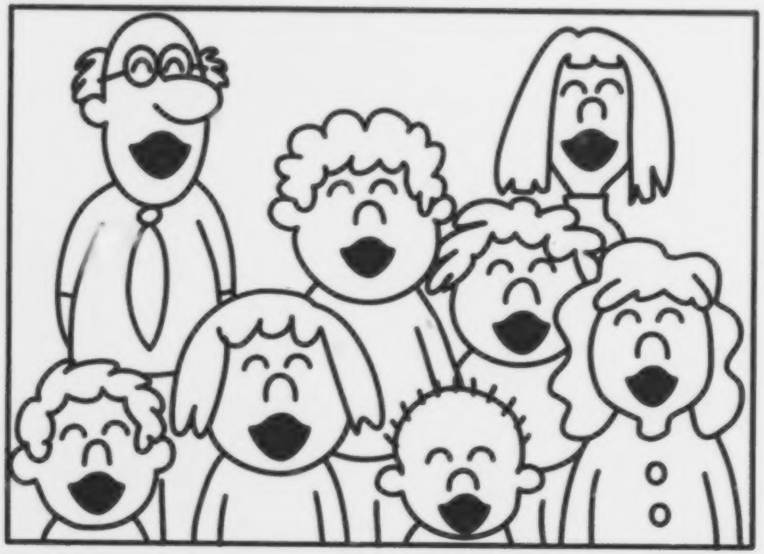
Picture 2: Well, I saw people use it for other things, too–

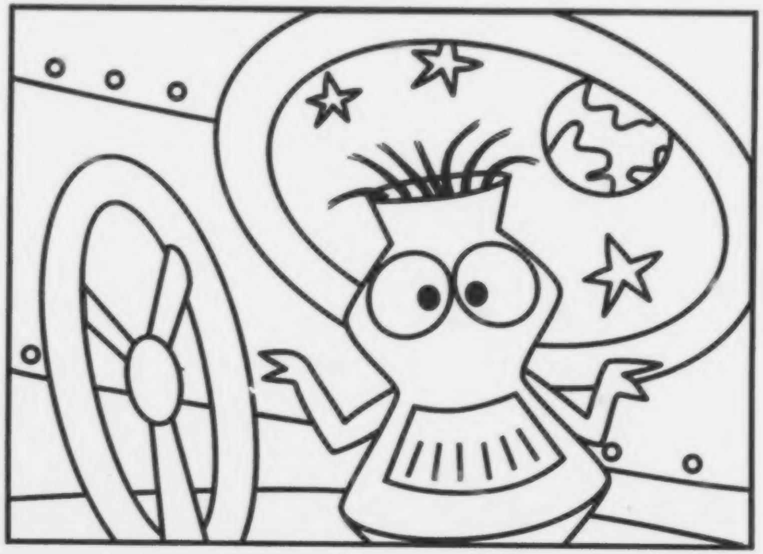
Picture 3: like this–

Picture 4: and this.









Master 1.1o

Master 1.1p

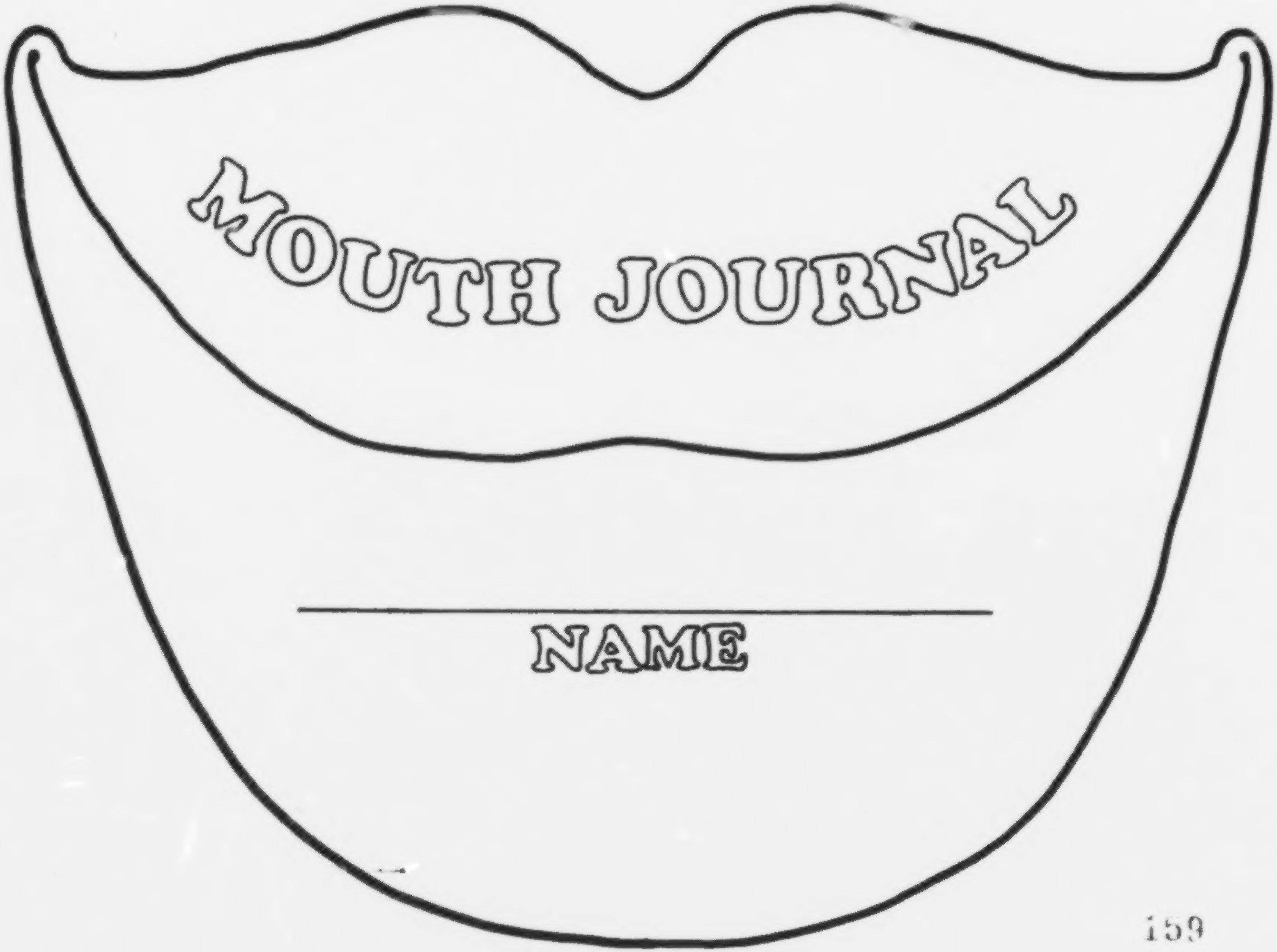
Picture 1: Now I'm really confused!

Picture 2: How does it work?

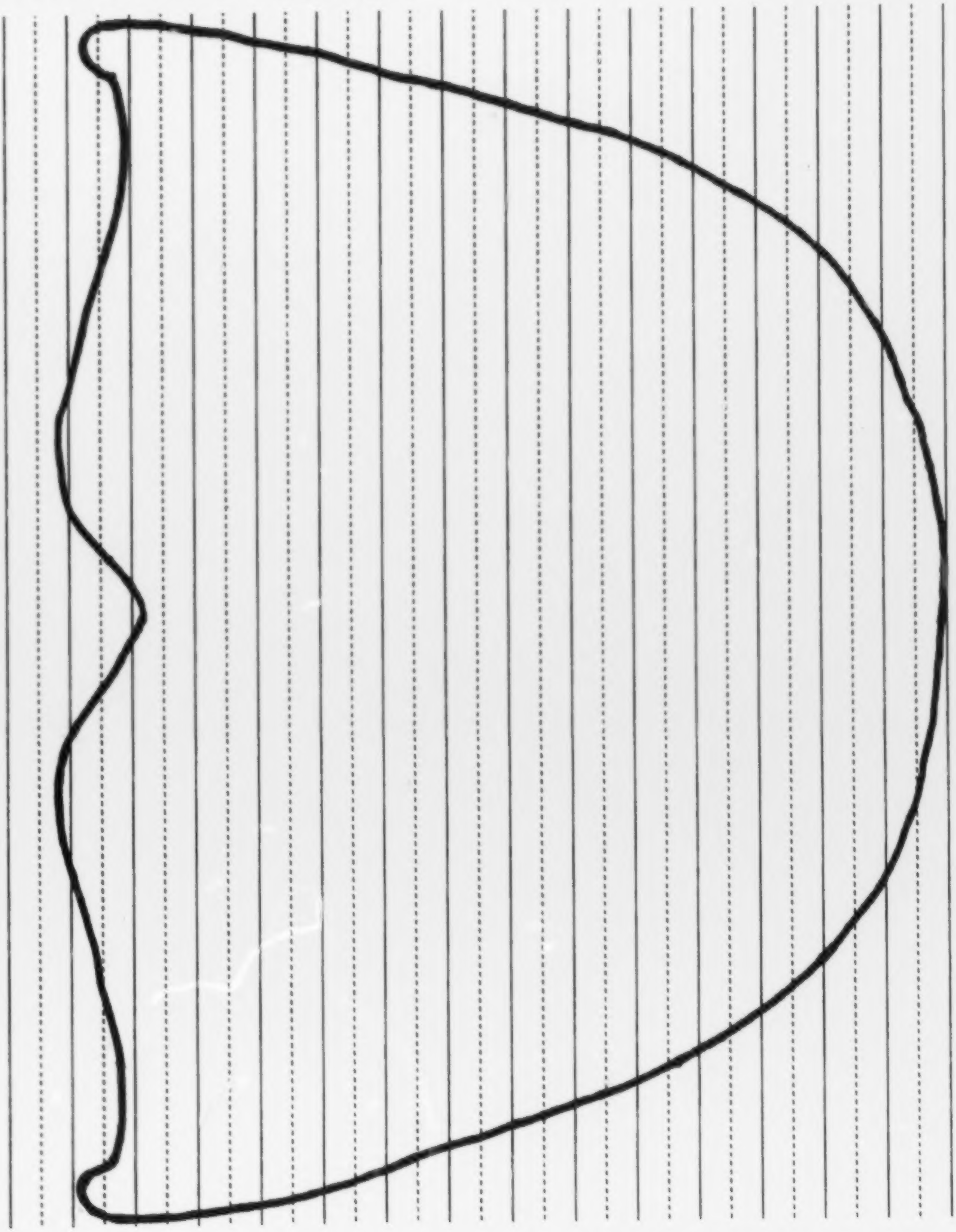
Picture 3: What's inside?

Picture 4: Will you help me find out more about mouths?

page 8)


MOUTH JOURNAL
NAME

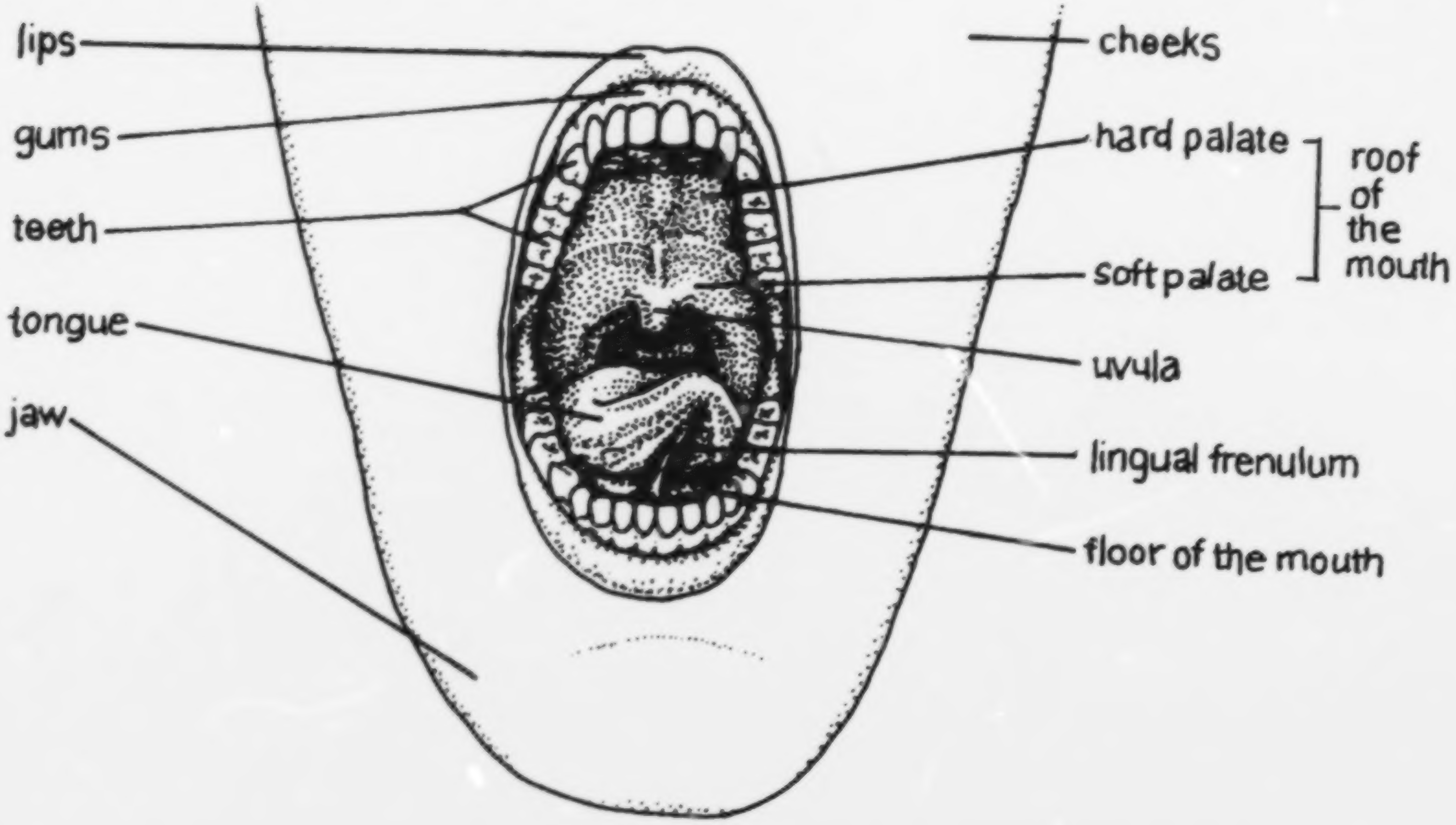
Mouth Journal Writing Pages



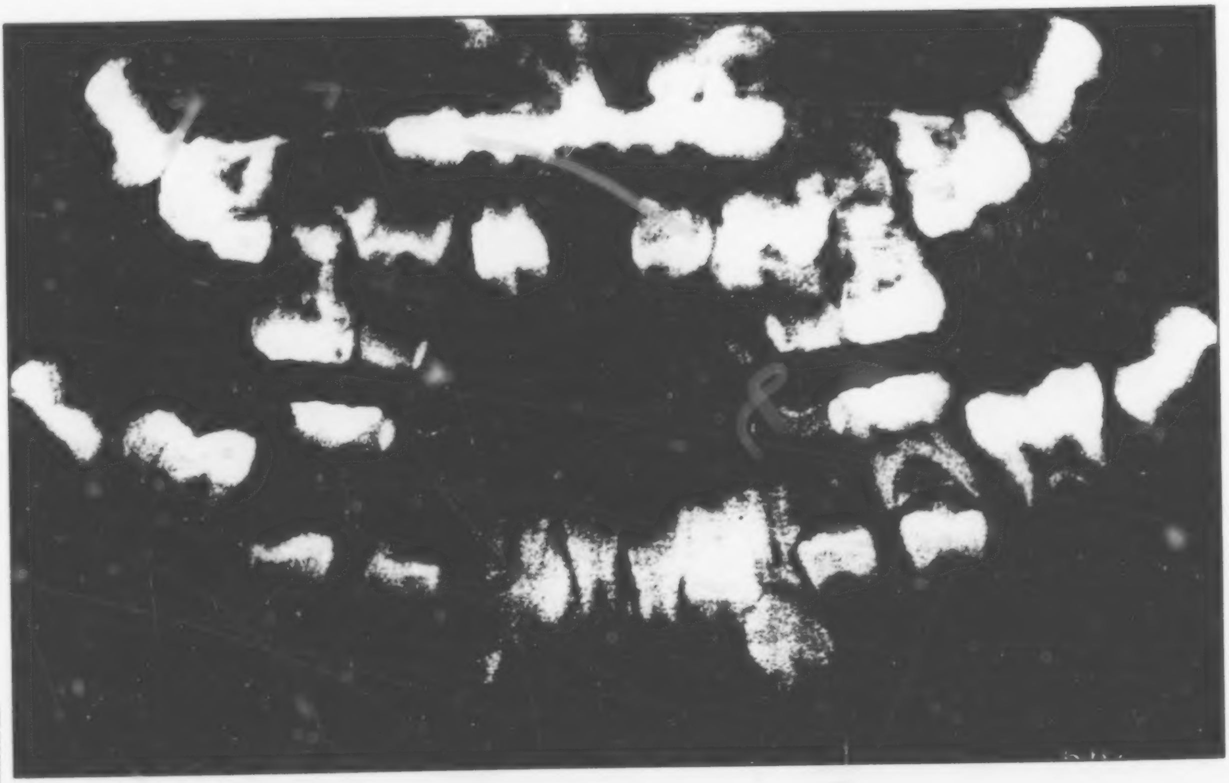
Master 1.3

The Parts of the Mouth

Master 2.1


lips
gums
teeth
tongue
jaw
cheeks
hard palate
soft palate
roof of the mouth
uvula
lingual frenulum
floor of the mouth

Mouth X-Ray



Master 2.2

Take-home Activity 1: My Tooth Record

Note to parents: This is the first of three activities that you and your child can do together at home. These take-home activities reinforce what your child is learning at school. On the front of each take-home activity sheet are directions for you and your child to follow. On the back of each sheet is important background information for you. When you finish the activity, fill in the Certificate of Completion and return it to school.

At school, your child is learning about teeth: what teeth look like, what different jobs they do, and how many teeth each student has in his or her mouth. To prepare for a graphing lesson at school, count the number of teeth your child has in his or her mouth.

Materials

1 toothbrush or Popsicle stick
1 mirror

Procedure

1. Stand next to your child in front of the mirror. Open your mouths wide. Look in the mirror and see the teeth in both mouths. Who has more teeth? Record your answer on the Certificate of Completion.

2. Use the clean handle of a toothbrush or a clean Popsicle stick. While your child looks in the mirror, point to each tooth in his or her mouth and count it. Count both the top and bottom teeth. Record the total number of teeth on the Certificate of Completion.

3. Are there any missing teeth in your child's mouth? Are there any loose teeth? Are there any new teeth just coming in? Look in your child's mouth and count any missing, loose, or new teeth. Record your findings on the Certificate.

4. For fun, let your child count your teeth. Open wide and let your child hold the toothbrush or Popsicle stick and touch each of your teeth while counting. Ask your child to tell you if a tooth is an incisor, a canine, or a molar. Let your child tell you what job each tooth has.

Certificate of Completion

(complete and return to your child's teacher)

Who has more teeth? ______________________________

How many teeth did you count in your child's mouth? ______________________________

Are there any missing, loose, or new teeth? ______________________________

Parent's or guardian's signature ______________________________

Child's signature ______________________________

Background Information

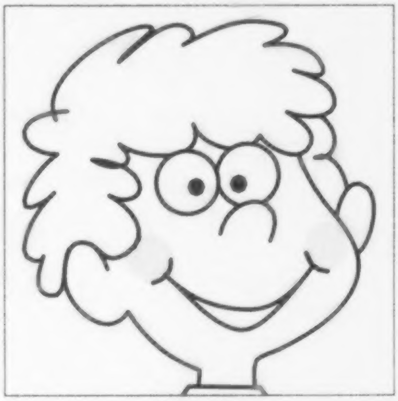
Can you remember when your child's first teeth began to appear? Usually, the first "baby" (primary) tooth appears between the ages of six months to one year. By age two or three, most children have all 20 primary teeth.

Now your child is beginning to lose these primary teeth. As a natural part of growth, the roots of the primary teeth dissolve. When the permanent teeth begin to erupt, or appear in the mouth, the primary teeth fall out.

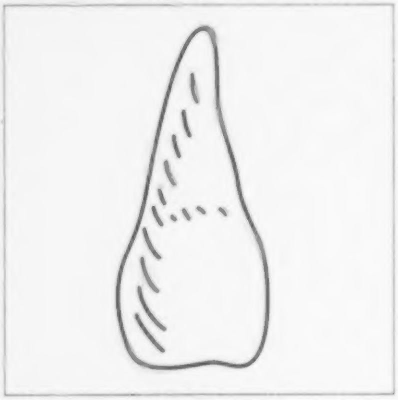
Even before your child loses his or her first tooth, the first permanent tooth usually has appeared. Behind the primary molars in your child's mouth are his or her 6-year molars. These are the first teeth that your child will have forever. As your child grows and becomes an adult, these molars will be doing their job of chewing food, helping form speech, and stabilizing the shape of the face.

These very important teeth deserve special attention so that they will last a lifetime. Dental professionals recommend using sealants to protect their chewing surfaces from tooth decay. Sealants are thin plastic coatings that fill in the grooves on top of the molars where food can get stuck. Sealants act as a physical barrier that protects the tooth from acid that causes decay. Molars should be sealed soon after they appear in the mouth before decay can begin. Along with keeping the tooth healthy, sealants can save money because they usually cost less than filling the tooth. Sealants are an excellent investment in your child's oral health.

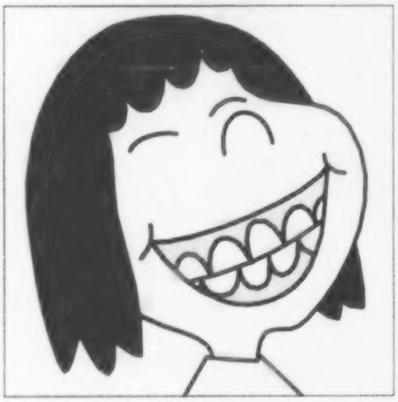
The Parts of My Mouth Game Cards



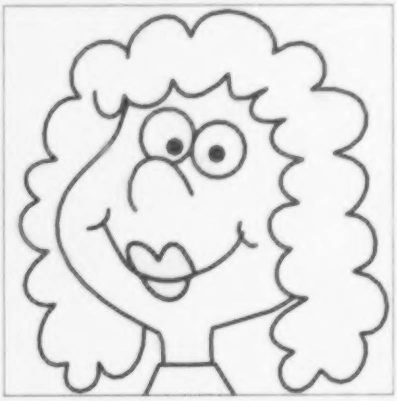
Cheeks



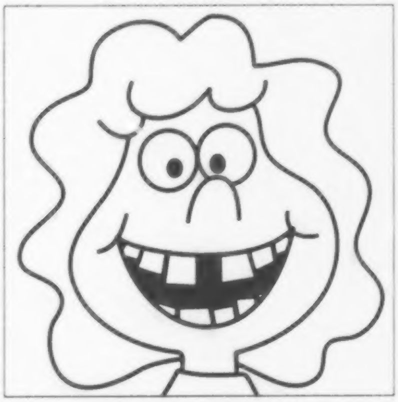
Incisor



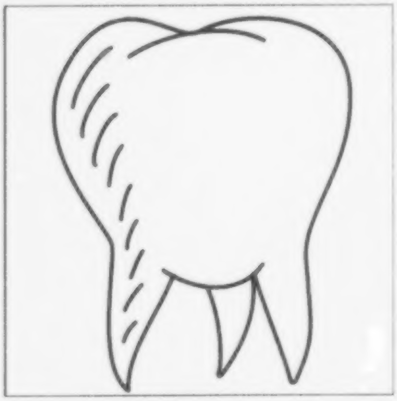
Gums



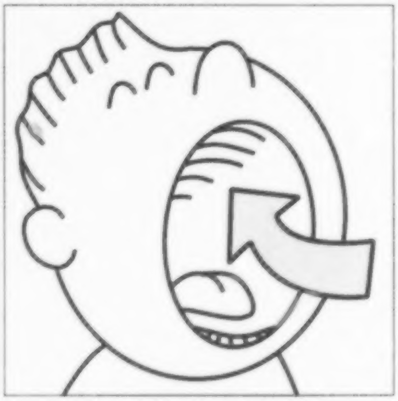
Lips



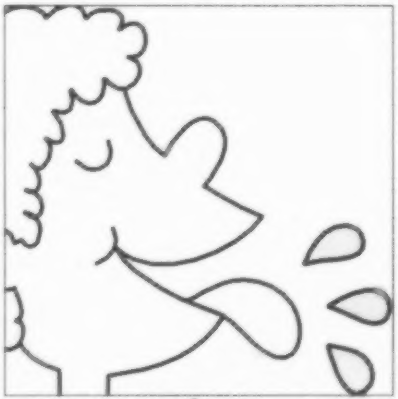
Missing Tooth



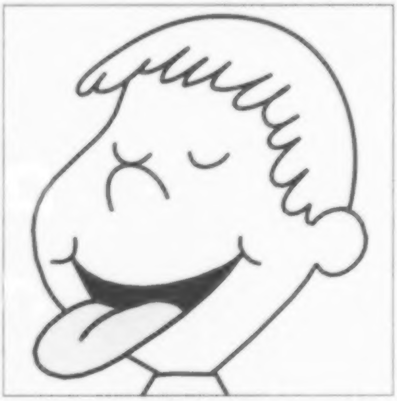
Molar



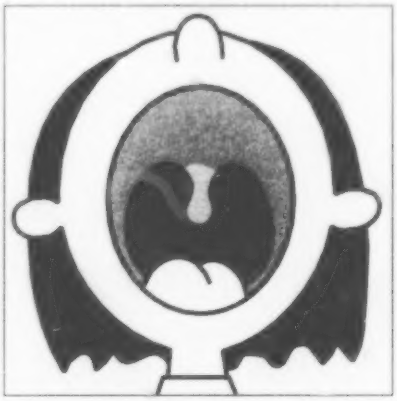
Roof of Mouth



Saliva



Tongue



Uvula

Apple Record Page

Scientist Names: ____________________ ____________________

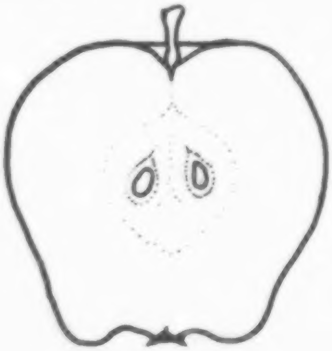
____

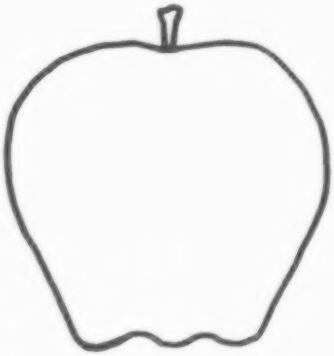
1. What will happen to our apple if ______________________________

____

____

2. This is what we did to our apple.
Draw a picture here.





Write what you did to your apple here.

____

____

____

3. We think our apple will ______________________________

____

4. This is a record of what happened to our apple.

Date	Our Experimental Apple	The Control Apple

5. After _____ days, our apple ______________________________________

____

____

Take-home Activity 2: So You Want to Be an Eggs-pert Scientist!

At school, your child is learning how to use a scientific model of a tooth (an apple) to investigate tooth decay. In this take-home investigation, you will use another model of a tooth (an egg) to find out what a weak acid can do to a hard surface, like the surface of a tooth.

Materials

egg cup
vinegar plastic wrap

Procedure

Day 1

1. **Begin the activity by observing the egg. Look at the eggshell and feel it. Is it hard or soft? Is it smooth or bumpy? Is it cool or warm? Look out—don't drop it! Is an egg anything like a tooth?**

2. **Place the egg in the cup. Help your child carefully pour vinegar, a weak acid, over the egg until it completely covers the egg. Watch the egg for 5 minutes. What do you see? Cover the cup with plastic wrap. Leave the egg sitting on the counter for about a day. Write down the date and time when you set up the investigation on the Certificate of Completion.**

3. **Discuss with your child what you think might happen to the egg. Write down your guesses.**

Day 2

1. **Get ready to check the egg! Write down today's date and time on the Certificate. Carefully pour the vinegar into another cup or down the drain. Observe the egg. What happened to the shell? Is the shell hard or soft? Is the shell smooth or bumpy? Is it cool or warm? Talk about your observations and write down the results.**

2. **Gently try to poke a hole in the eggshell with a pencil. Watch out! Do this over a sink. What happens?**

3. **Answer the questions on the Certificate of Completion. Then, throw away the egg when you are finished. Do *not* eat it.**

- -

Certificate of Completion

(complete and return to your child's teacher)

Date and time investigation started: ____

Our guess was that the egg would: ____

Date and time finished: __________ ______________ **We left the egg in vinegar for** _______ **hours.**

At the end of the investigation, the egg was:____

Background Information

In this take-home activity, you will do an investigation to find out what acid can do to an egg. The egg serves as a model for a tooth. You might ask, "How is an egg like a tooth?" The shell of an egg is hard like the outer surface of a tooth. Both are soft on the inside. In fact, many of the same minerals are in both the tooth enamel and an eggshell.

Scientists often use models. A model, although not the same as the real object, helps scientists learn about things that are difficult to study with a direct experiment. If scientists need to find out if a new chemical is safe for humans to use, they often test the chemical on animals, such as rats or mice. Safety engineers use crash dummies to test the effectiveness of seat belts and air bags in automobiles. The information that scientists learn using models helps them make predictions about real-life situations.

At school, students are using apples as models of a tooth. They are poking holes in the apples and waiting to see what happens to them, particularly around the holes. In this take-home activity, you are exposing the hard surface of an egg to a weak acid and waiting to see what happens to the eggshell. Both of these investigations use models and provide students with experiences they can use to make predictions about what might happen when a tooth has a cavity (hole) in it or when a tooth is exposed to the weak acids that are produced in all of our mouths. Students will learn more about the acids that can cause tooth decay. In this way, students are modeling the way real science works.

- - - - - - - - - - - - - - - - - - - -

What do you think happens to your teeth when there are acids in your mouth?

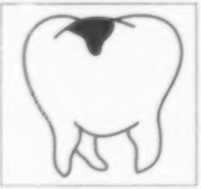
____

Which do you think is a better model for a tooth, an apple or an egg? Why?

____

Parent's or guardian's signature ______________________________

After the bacteria eat, they produce acid. The plaque holds the acid against the surface of your teeth. The acid can make holes in your teeth if it is held there for a long enough time. When you eat sugary foods, the bacteria make a lot more acid. They also make a lot more bacteria. More bacteria produce more acid. More acid on your teeth can cause more decay.

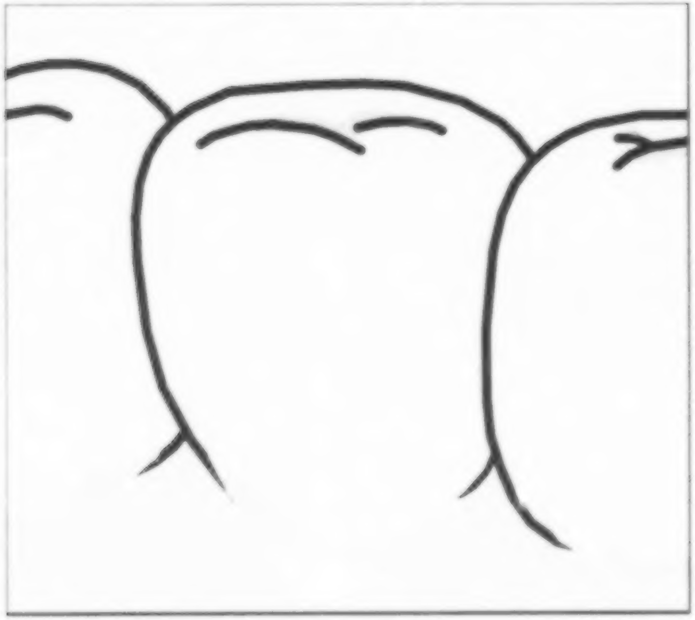


Now, do you know why it is important for you to brush your teeth and eat healthy, not sugary, foods?

Master 4.1a

ANIMALS DO MORE THAN EAT AND DRINK

Animals live almost everywhere on Earth. Some animals are very large, and some animals are very, very, very, very small. What do all animals do to survive?



Master 4.1b

The bacteria live together, in groups called **colonies**, all around your teeth and gums. They make some gluey stuff that holds them onto your teeth and helps them trap very small pieces of food you eat. Have you ever noticed that you can scrape some white stuff off your teeth when you wake up in the morning or before you go to bed at night? That stuff is called **plaque**. That's where the bacteria live. Plaque is kind of like a net that helps the bacteria catch and hold on to food for them to eat.

All animals eat some kind of food, and all animals take in water. Do you know what else animals do? Listen to this story and find out.

Polar bears live in the icy, northern part of the world.
They eat meat like fish and seals.
They make baby polar bears.
All polar bears poop.

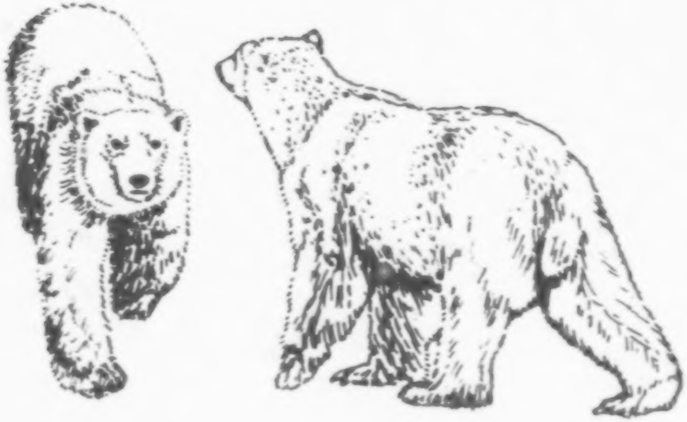
When you eat and drink something, the bacteria that live on and around your teeth and gums eat tiny bits of the food that is in your mouth. They even have ways to save some of the food to come back and snack on later!

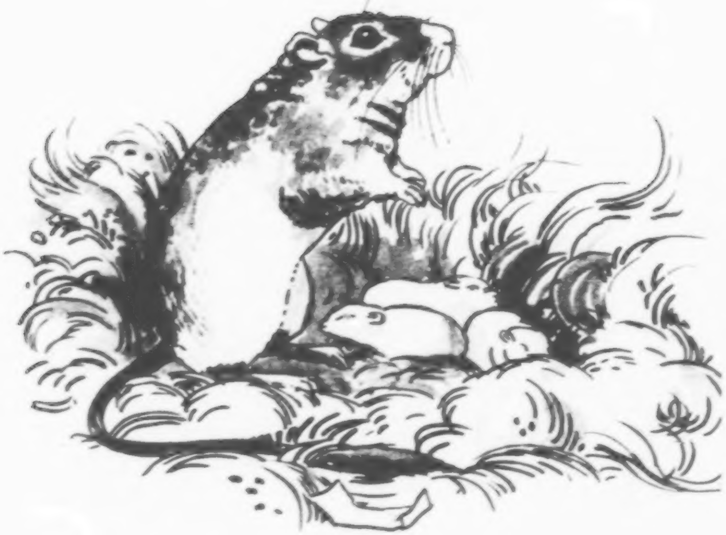
Some of the bacteria help you stay healthy, but some of the bacteria produce acid that can cause cavities in your teeth.

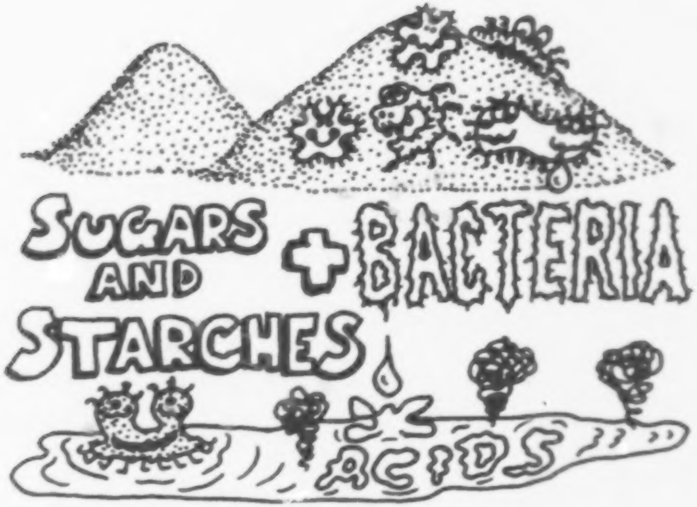
What happens to the acid the bacteria produce?

If the acid stays on your teeth, it can make holes in your teeth. Here is how it works.

Since the day you were born, different kinds of bacteria have lived in your mouth—and in every person's mouth. The bacteria are very, very, very, very tiny. You cannot see them with your eyes.






SUGARS AND STARCHES
+
BACTERIA
ACIDS

Master 4.1f

Master 4.1g

So let's review.

Bacteria live in your mouth.
Some of them eat what you eat.
They make other bacteria.
Some bacteria produce acid.
In your MOUTH?
Yes, bacteria produce acid in your mouth.

Gerbils live in burrows in high deserts and prairies.
They eat seeds and parts of plants.
They make baby gerbils.
All gerbils poop.

Guppies live in ponds.
They eat mosquito larvae and other tiny bugs.
They make baby guppies.
All guppies poop.

Well, other animals, like polar bears, gerbils, guppies, and earthworms, poop. But, what is poop, really? What we call "poop" is a **waste product**. All animals produce some kind of waste product because their bodies cannot use all the parts of the foods they eat. After they eat, bacteria produce an **acid**. The acid is the bacteria's waste product, or its poop.

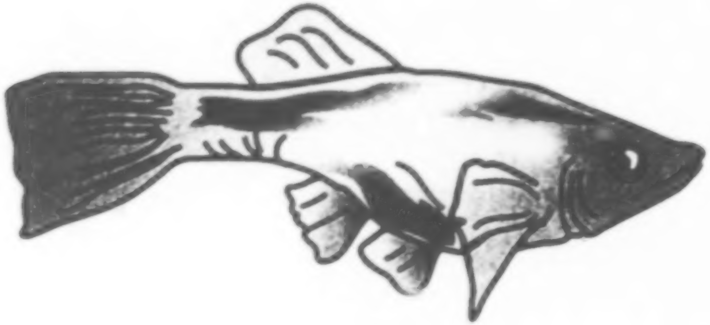
Master 4.1h

Master 4.1i

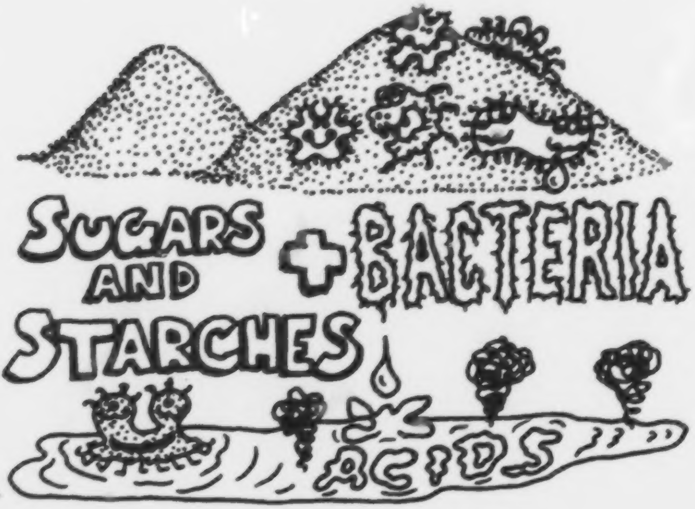
So, bacteria live in your mouth.
Some of them eat what you eat.
They make other bacteria.

Do the bacteria poop?

In your MOUTH?



These bacteria do make other bacteria. They make even more bacteria when they get sweet things to eat.


SUGARS AND STARCHES
+
BACTERIA
ACIDS

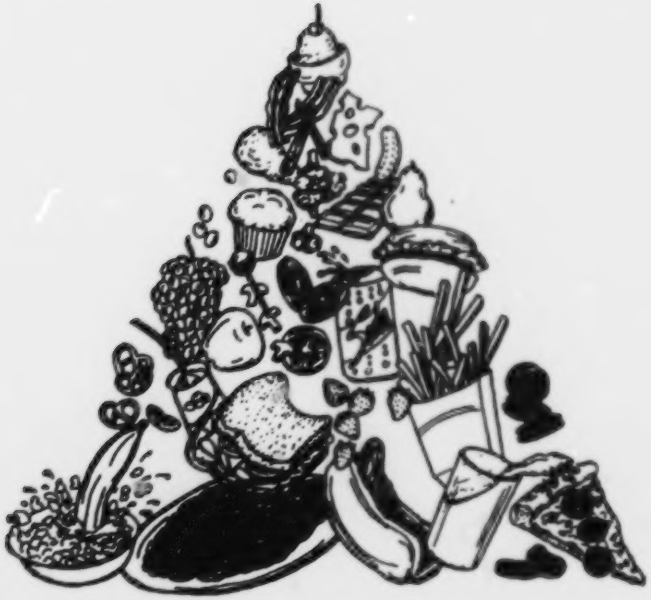
Master 4.1k

Bacteria live in your mouth.
Some of them eat what you eat.

Do they make other bacteria?

Earthworms live in the soil.
They eat decaying stuff in the dirt.
They make baby earthworms.
All earthworms poop.

Bacteria live in your mouth.
Wait a minute!
I have bacteria living in my **MOUTH?**
What are bacteria doing in my mouth?
Are you sure?



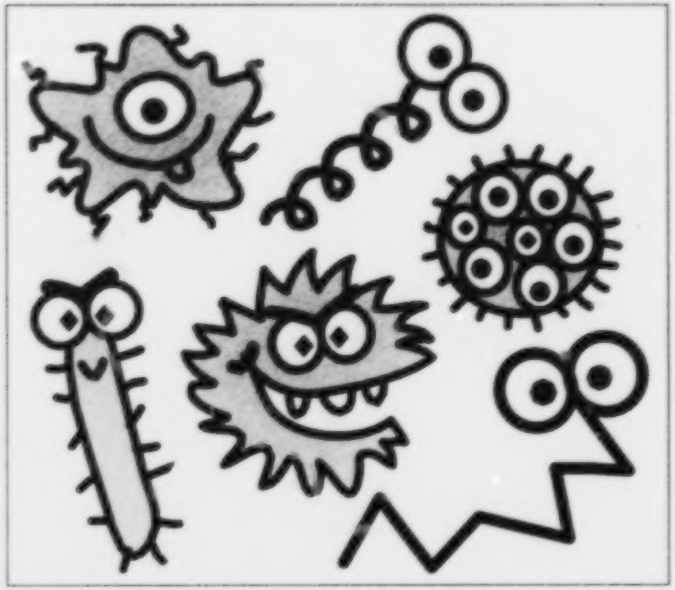
Master 4.11

Master 4.1m

Some bacteria eat what you eat.
They eat peanut butter and jelly
sandwiches,
macaroni and cheese, and
pizza.

But, do you know what they are
really good at eating?

Just like most kids, the bacteria in
your mouth are really good at eating
candy!



Some bacteria live where it is

dark

and warm

and wet.

Some of those bacteria
live in your mouth.

What do you think they eat?

Master 4.1n

Take-home Activity 3: Brushing to the Beat!

At school, your child is learning about what happens in his or her mouth to cause tooth decay. This take-home activity will reinforce proper brushing as a way to prevent tooth decay. Have fun "brushing to the beat"!

Materials

1 watch with a second hand
toothbrush and a pea-sized amount of fluoride toothpaste

Procedure

1. While you time him, ask your child to brush his teeth. Do not let him see your watch. Tell him to stop brushing when he thinks he has brushed for two minutes, the recommended length of time to clean the teeth thoroughly.

   How long did your child really brush? ________
   Is this more or less than two minutes? _________

2. If your child uses the proper technique, it is difficult not to brush for two minutes because it takes more time when done correctly. Review with your child the technique outlined in the *Background Information* (see reverse side).

3. It is more fun to brush to music. Think of a short, simple song that you and your child can hum all the way through, like *Twinkle, Twinkle, Little Star* or *Pop Goes the Weasel*, and record it on the Certificate of Completion. Then, hum it. Use your watch to see how long it takes you and your child to hum the song one time. Record the time on the Certificate of Completion.

4. How many times would you need to hum your song to make it last for two minutes? (For example, if one time through takes you 20 seconds, you would need to hum your song six times to make it last for two minutes.) Record the number of repeats on the Certificate of Completion. (If you need to estimate, go long—the extra brushing won't hurt!)

5. Now, try it. Have your child hum as she brushes her teeth. Help her keep count of the number of repeats. When she has brushed and hummed for the correct number of repeats, she's done. If your child uses this technique each time she brushes, she always will brush long enough to remove the bacteria that cause tooth decay.

- - - - - - - - - - - - - - - - - - - -

Certificate of Completion

(complete and return to your child's teacher)

Song title ____

Time it takes to hum once ________________ **Number of repeats to last two minutes** __________

Parent's or guardian's signature ______________________________

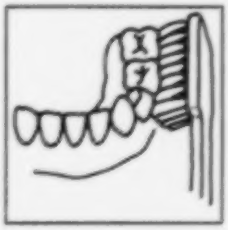
Child's signature ____

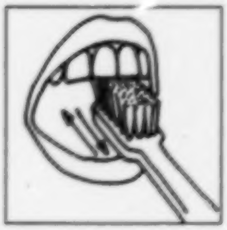
Background Information

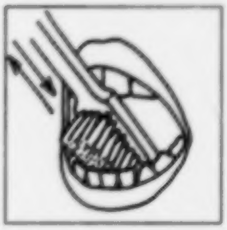
Your child has been learning about what can happen in the mouth to cause tooth decay. Ask your child to tell you about the following things:

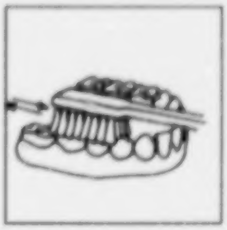
- Bacteria that live in the mouth are living organisms.
- Like all living things, bacteria eat, reproduce, and excrete waste.
- The waste that bacteria excrete is an acid that dissolves the tooth enamel.
- Bacteria like to feed on sugars and starches best. When you eat more sugary foods, the bacteria thrive. They eat more, reproduce more, and excrete more acid.
- To decrease the amount of acid in your mouth, you should avoid frequent snacking, especially sugary foods and drinks. You also should brush your teeth to remove bacteria, and the food particles that feed the bacteria, which together make a sticky film called plaque.

Dental professionals say that it takes **at least two minutes** of brushing to clean all the teeth and remove the plaque from the teeth. The American Dental Association (ADA) recommends the following procedure, using a pea-sized dab of fluoride toothpaste on a toothbrush with soft bristles:









- Brush outer surfaces with tips of bristles angled against the gum line. Move the brush back and forth with short strokes about one tooth wide.
- Brush inside surfaces.
- Brush chewing surface of the tooth by holding the brush flat.
- Brush inside surface of front teeth, top and bottom.
- Brush top of the tongue to remove more bacteria.

It is important to brush your teeth at least once a day, visit a dental health professional regularly, and eat a balanced diet to keep your mouth healthy.

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A Bad Day for Mr. Tooth Template Page

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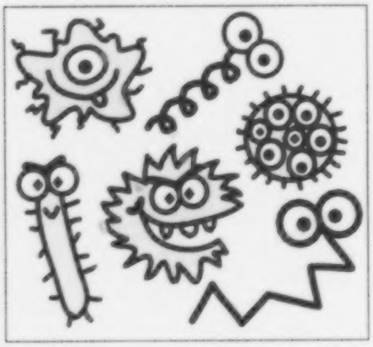
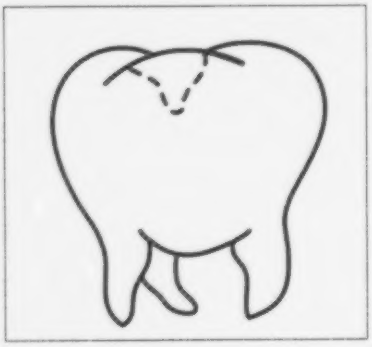
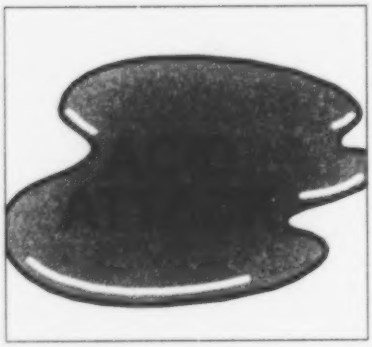
10	11	12

A Bad Day for Mr. Tooth Pictures



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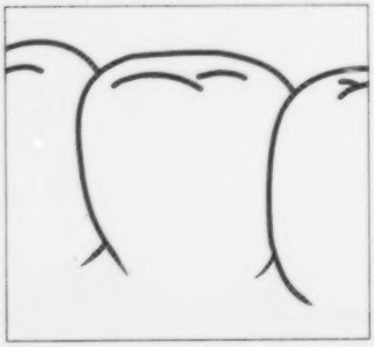

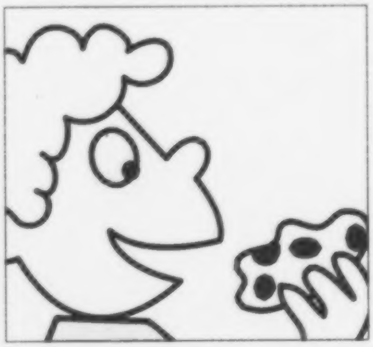

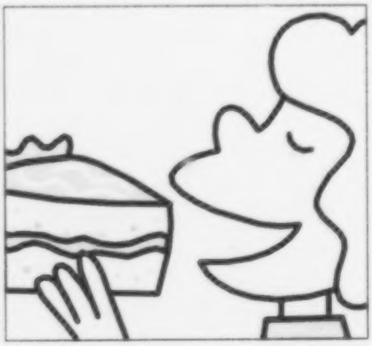

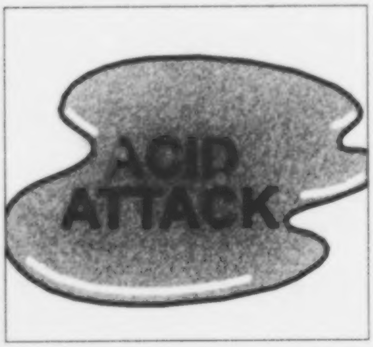
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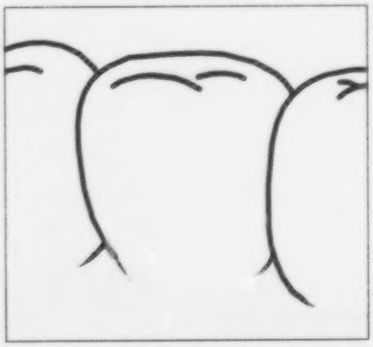

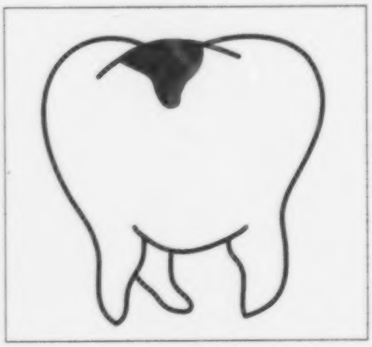

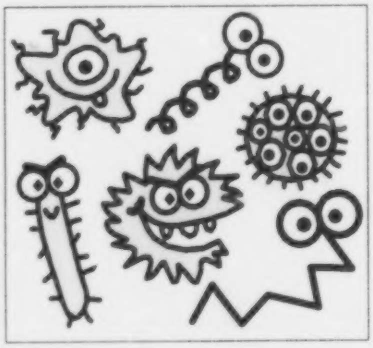

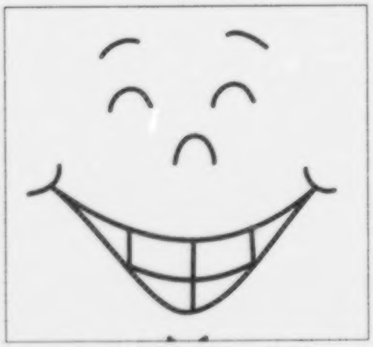

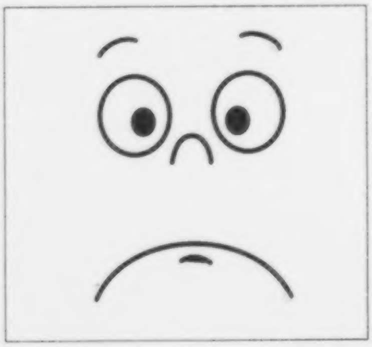

A Good Day for Mr. Tooth Template Page

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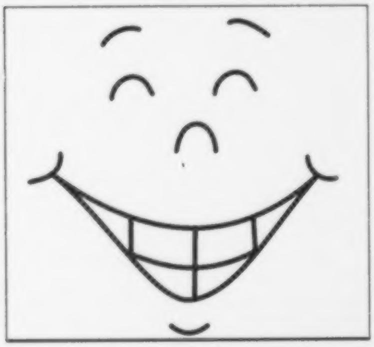
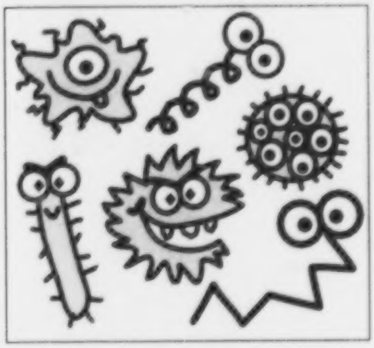
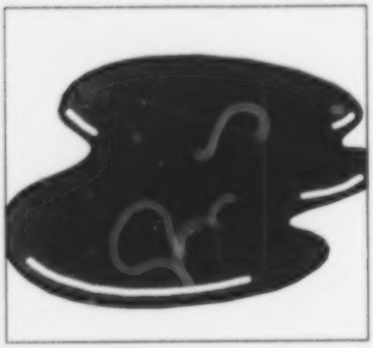
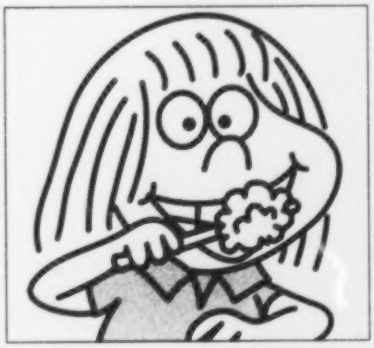
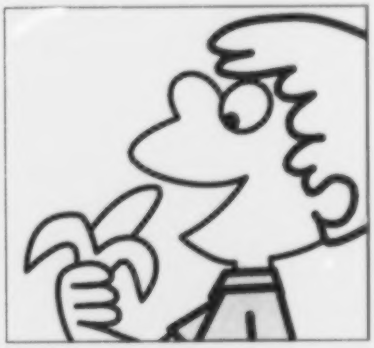
A Good Day for Mr. Tooth Pictures

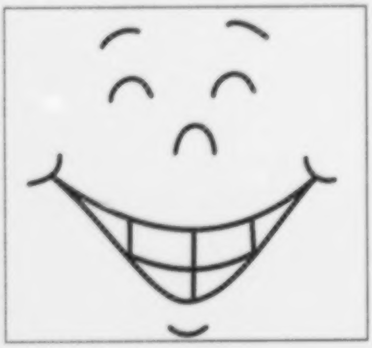


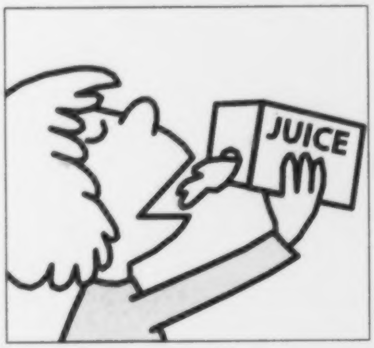


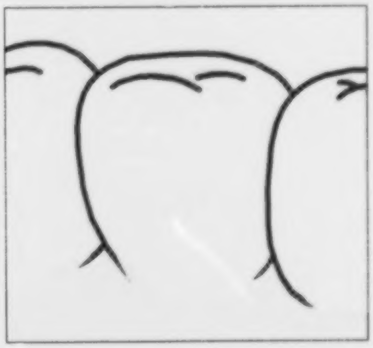


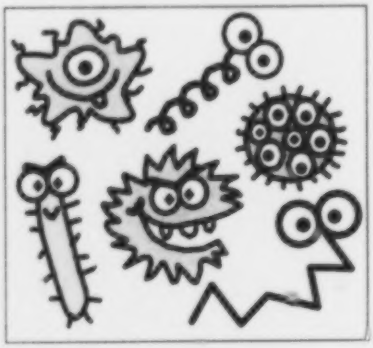


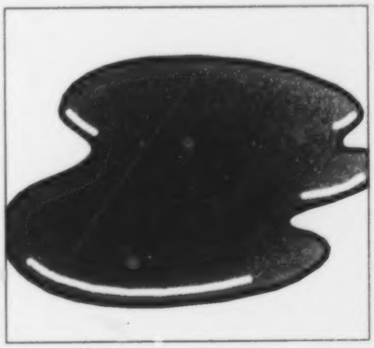


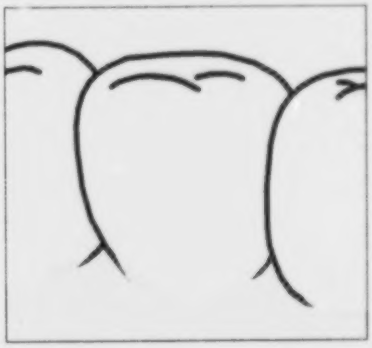


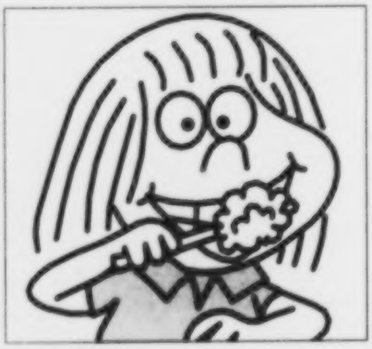






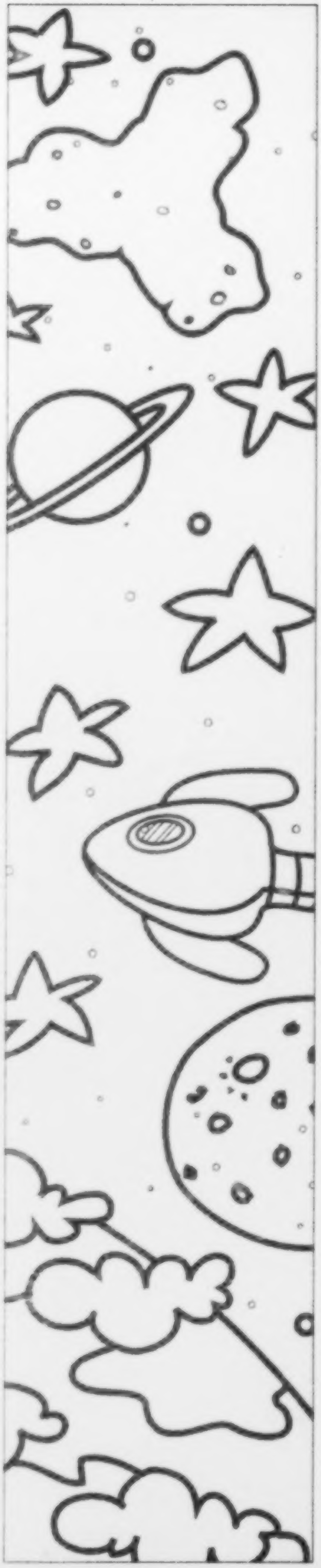






Master 6.4

Patrones



Lección 1. *¿Qué hace la Boca?*
Patrón 1.1. *Un Visitante del Espacio* .... copias para maestros
Patrón 1.2. *Diario de la Boca* .... copias para estudiantes
Patrón 1.3. *Hojas para el Diario de la Boca* ..... copias para estudiantes

Lección 2. Abre. *¿Qué hay Adentro?*
Patrón 2.1. *Las Partes de la Boca* .... transparencia
Patrón 2.2. *Radiografía de la Boca* .... original
Patrón 2.3. *Tarea 1: El Registro de mis Dientes* ...... copias para estudiantes
Patrón 2.4. *Las Partes de la Boca: Juego de Cartas* .... copias para estudiantes

Lección 3. *¡Investiguemos la Caries Dental!*
Patrón 3.1. *La Manzana: Hoja de Notas* .... copias para estudiantes
Patrón 3.2. *Tarea 2: ¡Así que quieres ser un gran científico!* .... copias para estudiantes

Lección 4. *¿Quiénes Viven en tu Boca?*
Patrón 4.1. *Los Animales Comen y Beben y Hacen Mucho Más* .... libro de cuentos para maestros

Lección 5. *¿Cómo Mantener la Boca Sana?*
Patrón 5.1. Tarea 3: *¡Cepillándose con Ritmo!* .... copias para estudiantes

Lección 6. *¿Qué Aprendiste Acerca de la Boca?*
Patrón 6.1. *Un mal día para el Señor Diente (Guía)* .... copias para estudiantes
Patrón 6.2. *Un mal día para el Señor Diente (Ilustraciones)* .... copias para estudiantes
Patrón 6.3. *Un buen día para el Señor Diente (Guía)* .... copias para estudiantes
Patrón 6.4. *Un buen día para el Señor Diente (Ilustraciones)* .... copias para estudiantes

Un Visitante del Espacio

Patrón 1.1a

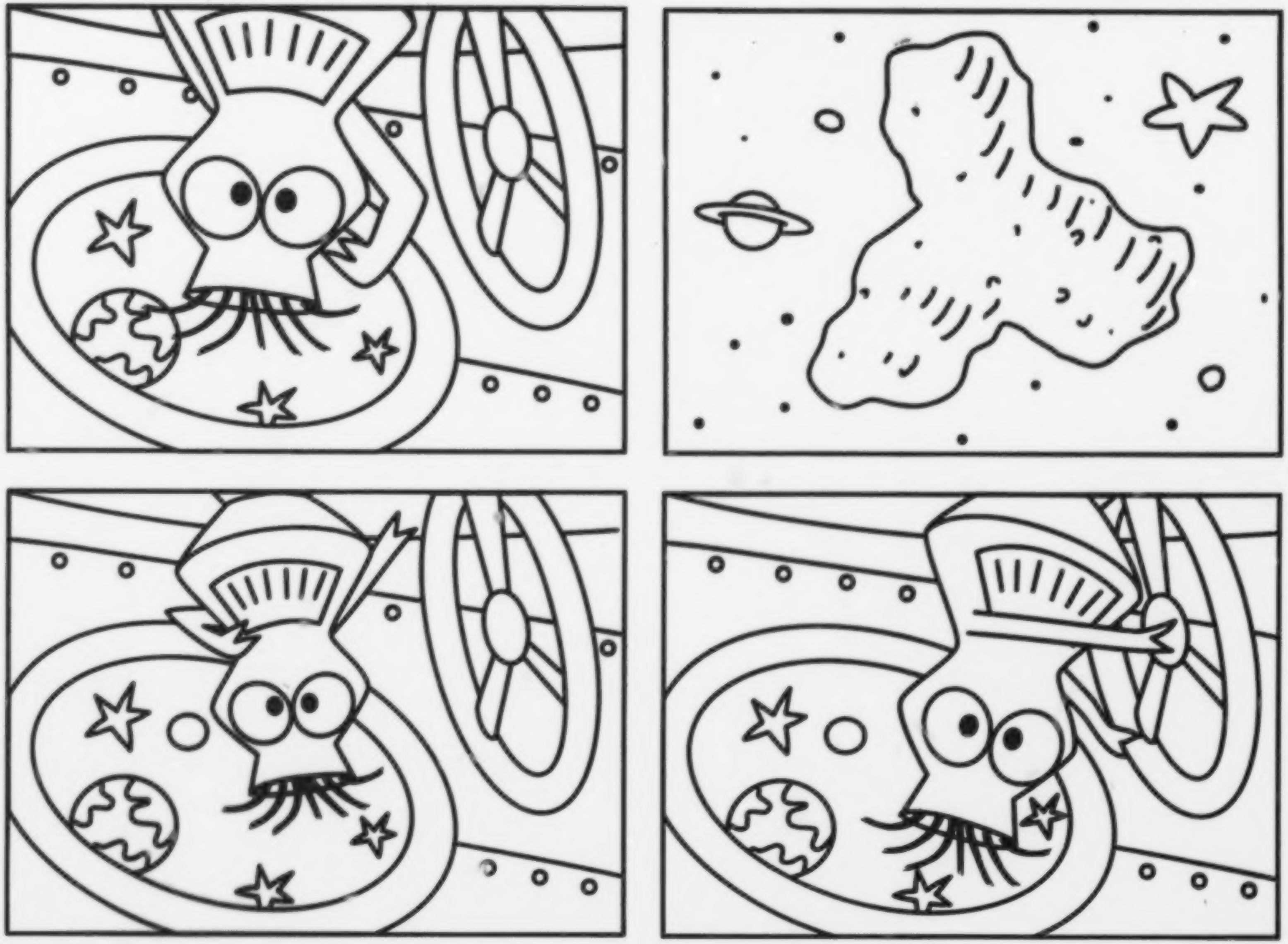


Ilustración 1: ¡Hola! ¡Bienvenido a mi nave!

Ilustración 2: Me llamo Exci, y vengo

Ilustración 3: del planeta Pregunta. Se llama así porque

Ilustración 4: nos encanta hacer preguntas. (Se toca la cabeza)

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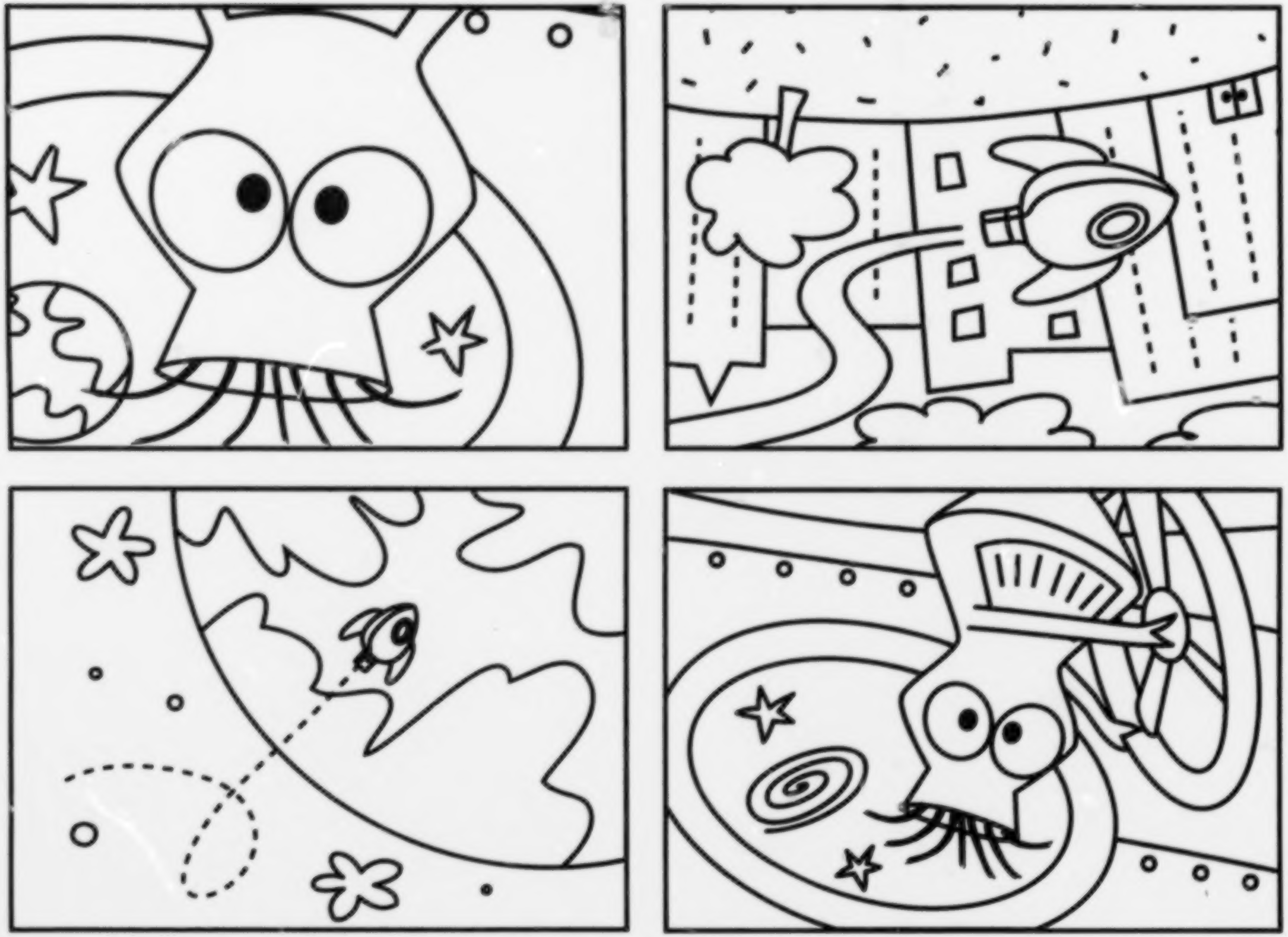


Patrón 1.1c

Patrón 1.1d

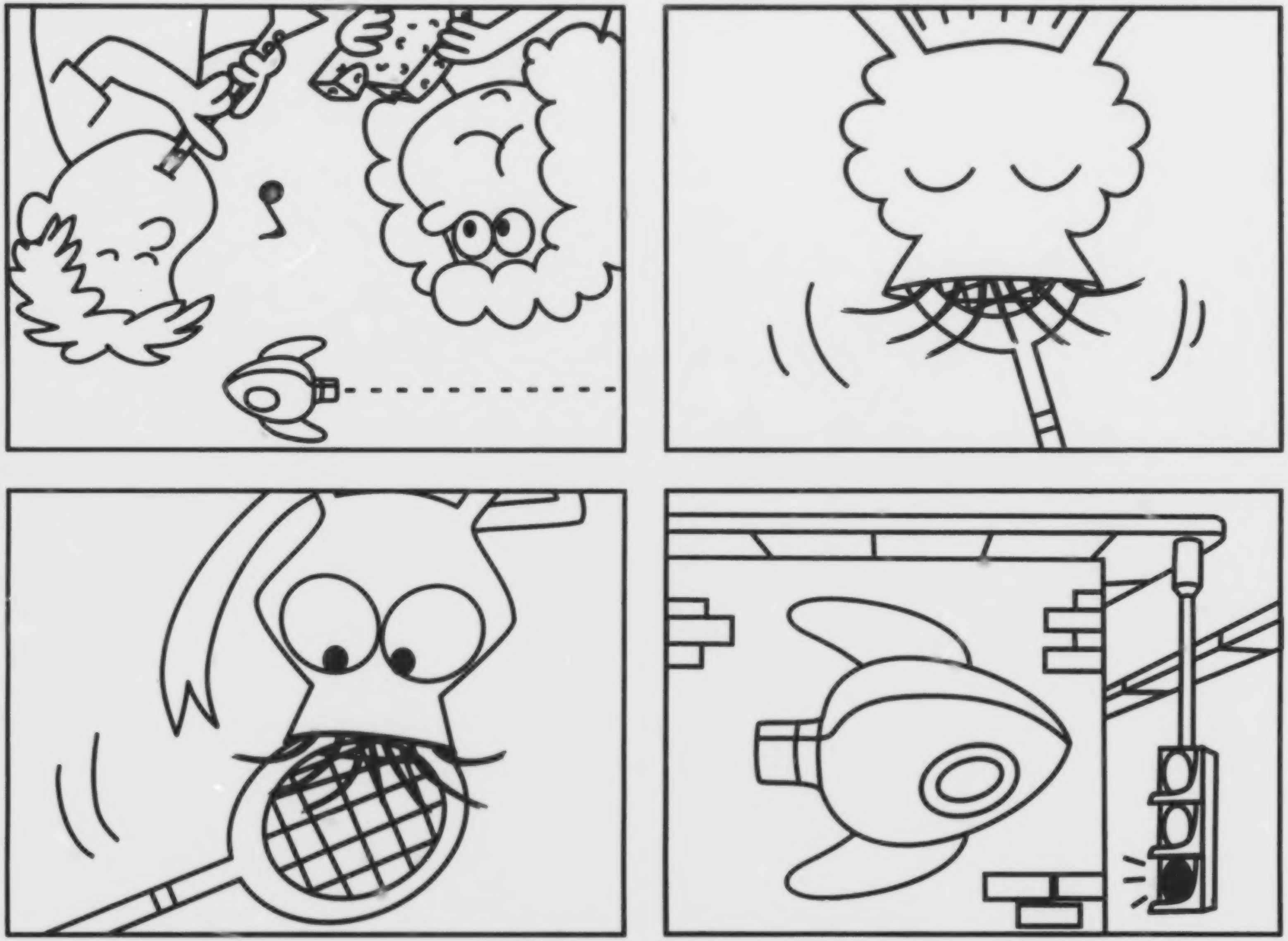
Ilustración 1: Hoy Viajamos al Planeta Tierra

Ilustración 2: para ver qué encuentro.

Ilustración 3: (Se pasea con rapidez)

Ilustración 4: Siempre sigo tres reglas:

Patrón 1.1e



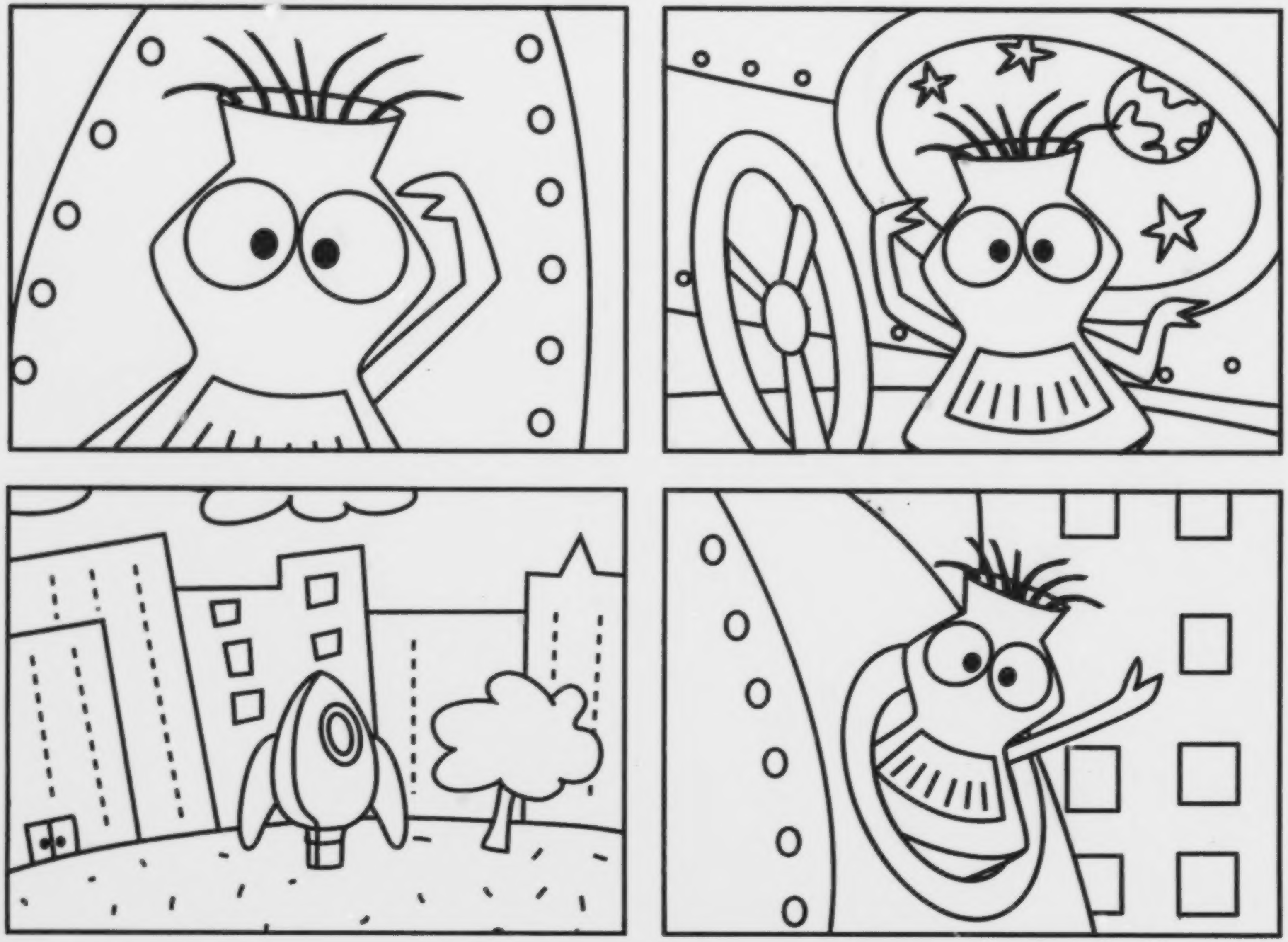
Patrón 1.1f

Ilustración 1: Obedecer los reglamentos locales. (Se detiene de pronto en el semáforo.)

Ilustración 2: Comer los alimentos locales.

Ilustración 3: Mmm ¡Algo chicloso!

Ilustración 4: (Vuela mientras los niños comen y tocan instrumentos musicales.)



Patrón 1.1g

Patrón 1.1h

Ilustración 1: Y la regla más importante... Hacer *muchas* preguntas.

Ilustración 2: ¡Yo siempre tengo *muchas* preguntas qué hacer!

Ilustración 3: (Vuela y aterriza.)

Ilustración 4: ¡Ven, pasa!

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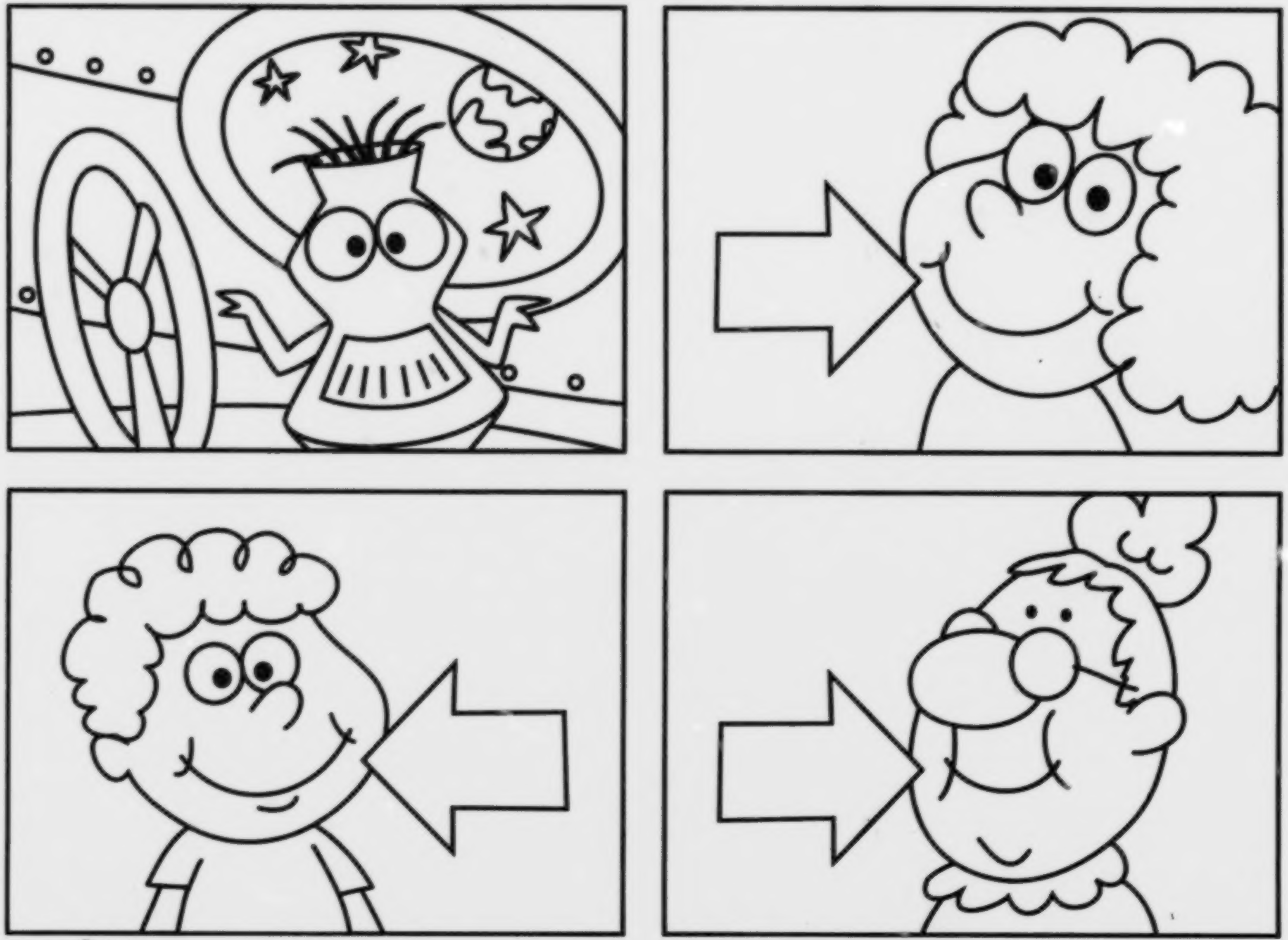


Patrón 1.1i

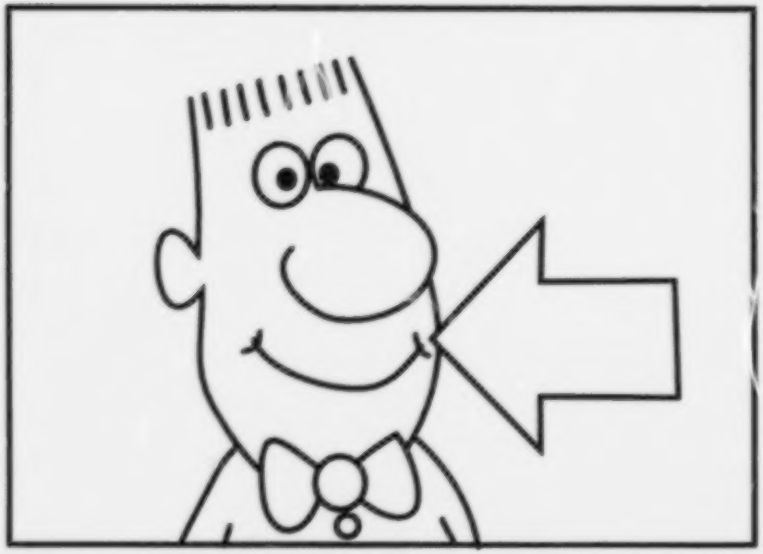
Patrón 1.1j

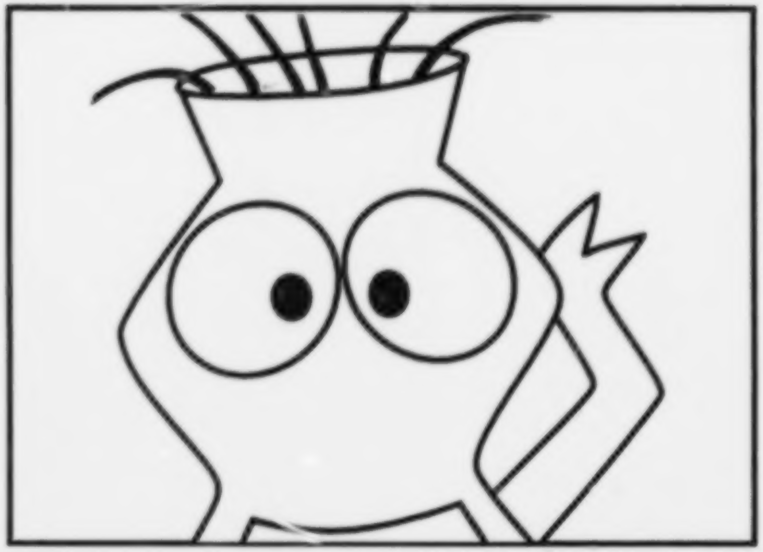
Ilustración 1: No quiero ser grosero, pero explícame ¿por qué en la Tierra la gente tiene

Ilustración 2: un tremendo agujero en la cara?

Ilustración 3: Jamás he visto tal cosa.

Ilustración 4: Y cada uno de ustedes tiene uno.





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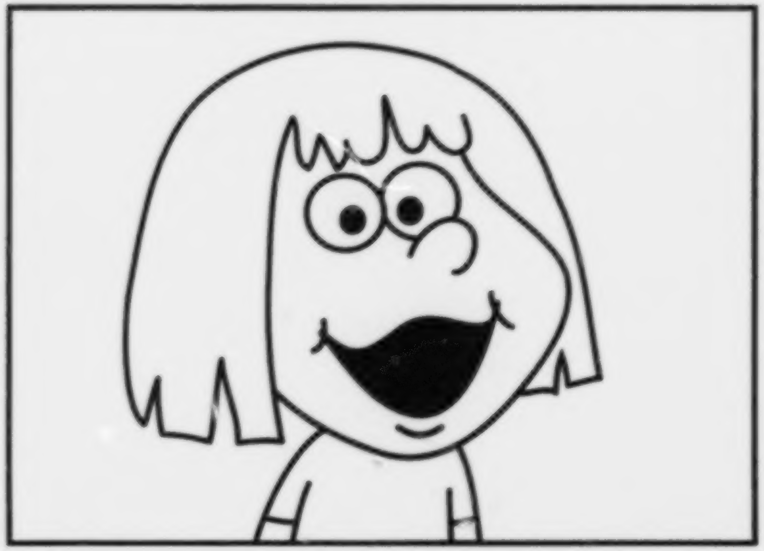
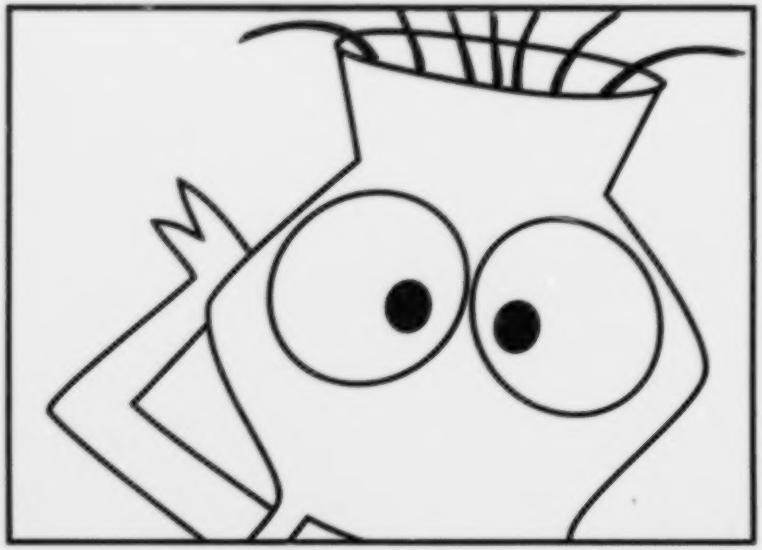




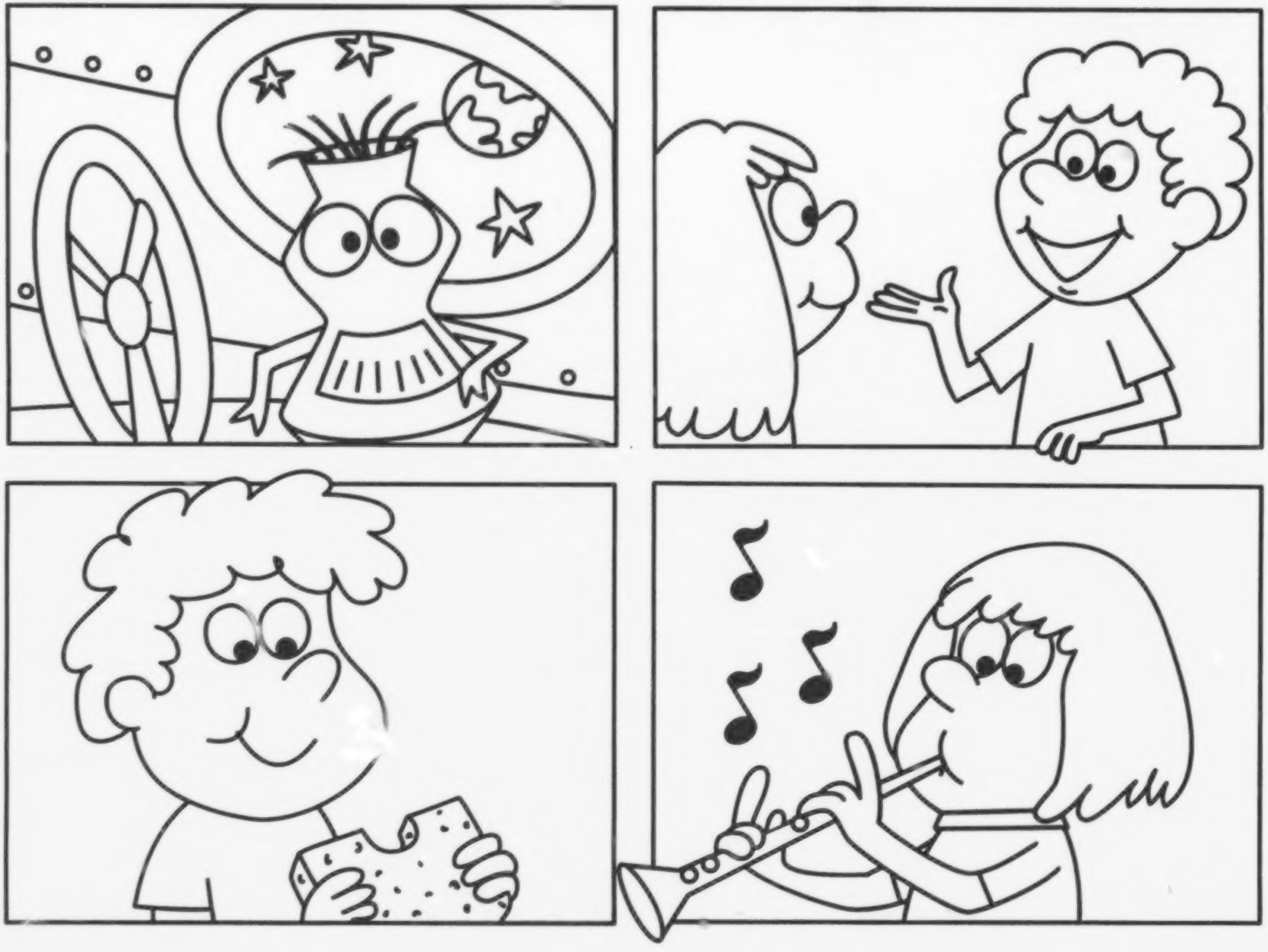
Patrón 1.11

Ilustración 1: ¿Cómo se llama ese hueco?

Ilustración 2: ¿Boca?

Ilustración 3: ¡Qué bárbaro!

Ilustración 4: ¿No te duele cuando la abres?



Patrón 1.1m

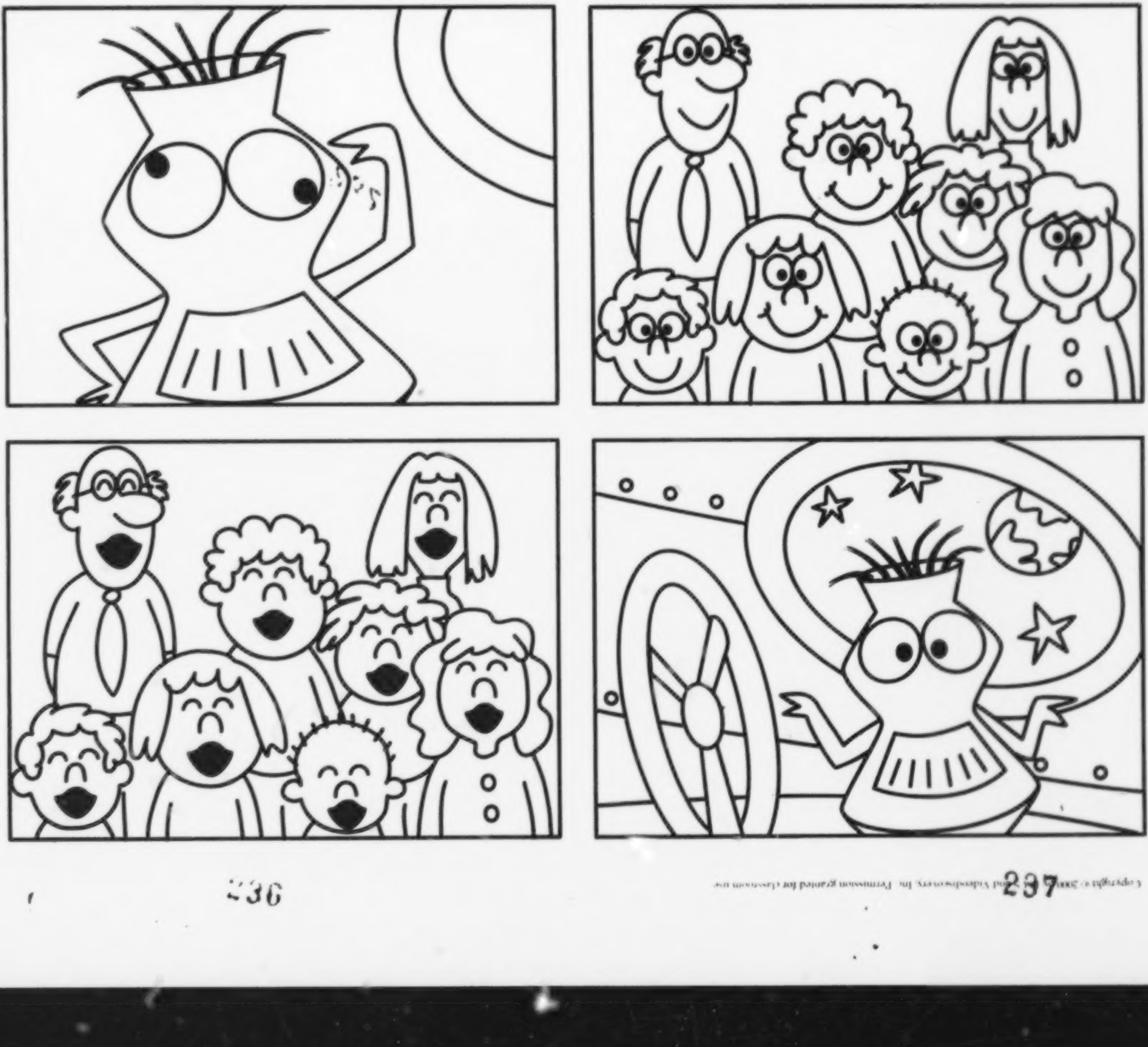
Patrón 1.1n

Ilustración 1: **¿Cómo?** ¿Sirve para hablar?

Ilustración 2: Bueno, he visto que la gente hace otras cosas con ella...

Ilustración 3: como esto...

Ilustración 4: y esto...



Patrón 1.1o

Patrón 1.1p

Ilustración 1: ¡Caramba, qué complicado!

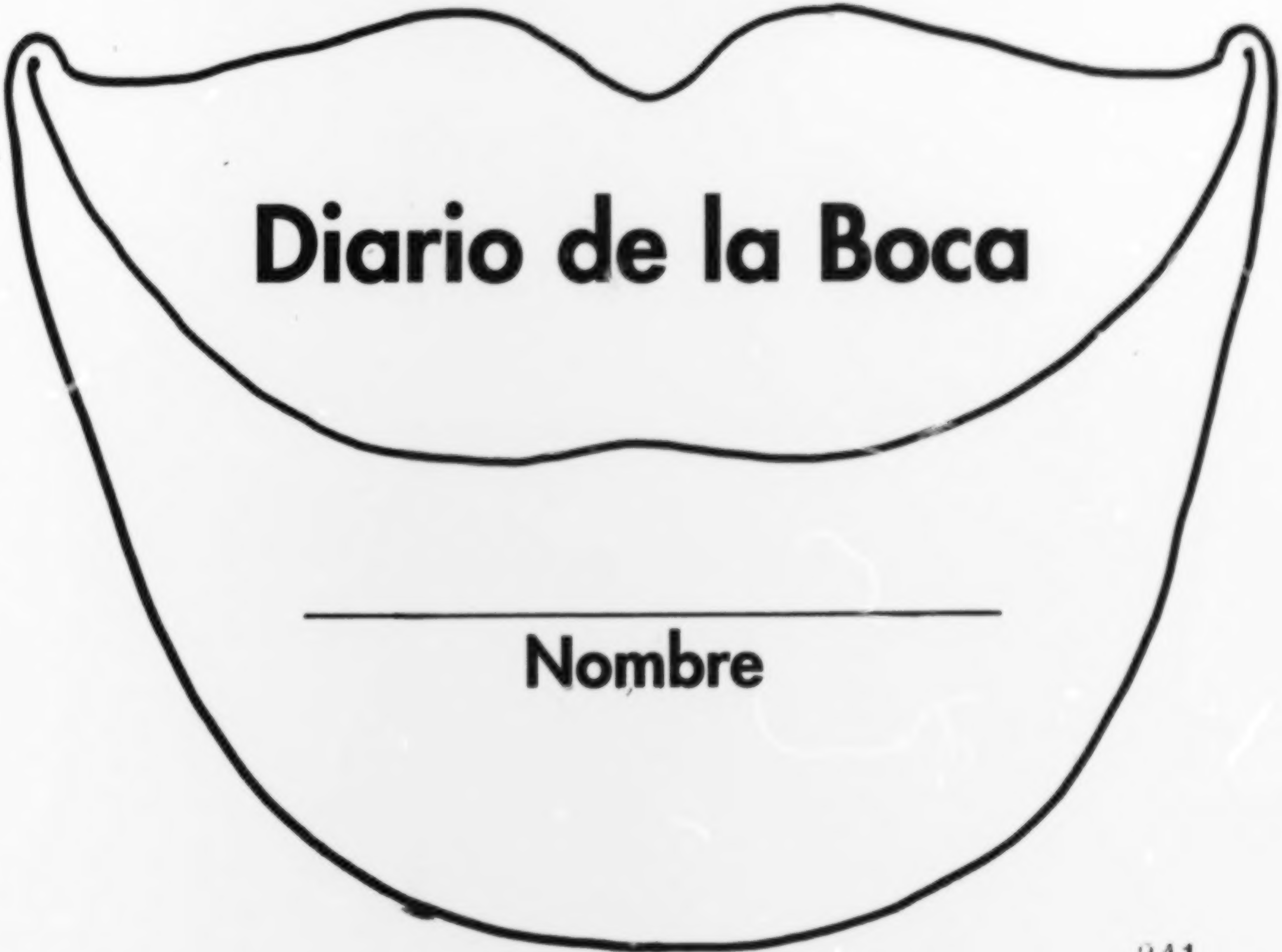
Ilustración 2: ¿Cómo funciona?

Ilustración 3: ¿Qué tiene adentro?

Ilustración 4: ¿Puedes explicarme más acerca de la boca?

Diario de la Boca

Patrón 1.2

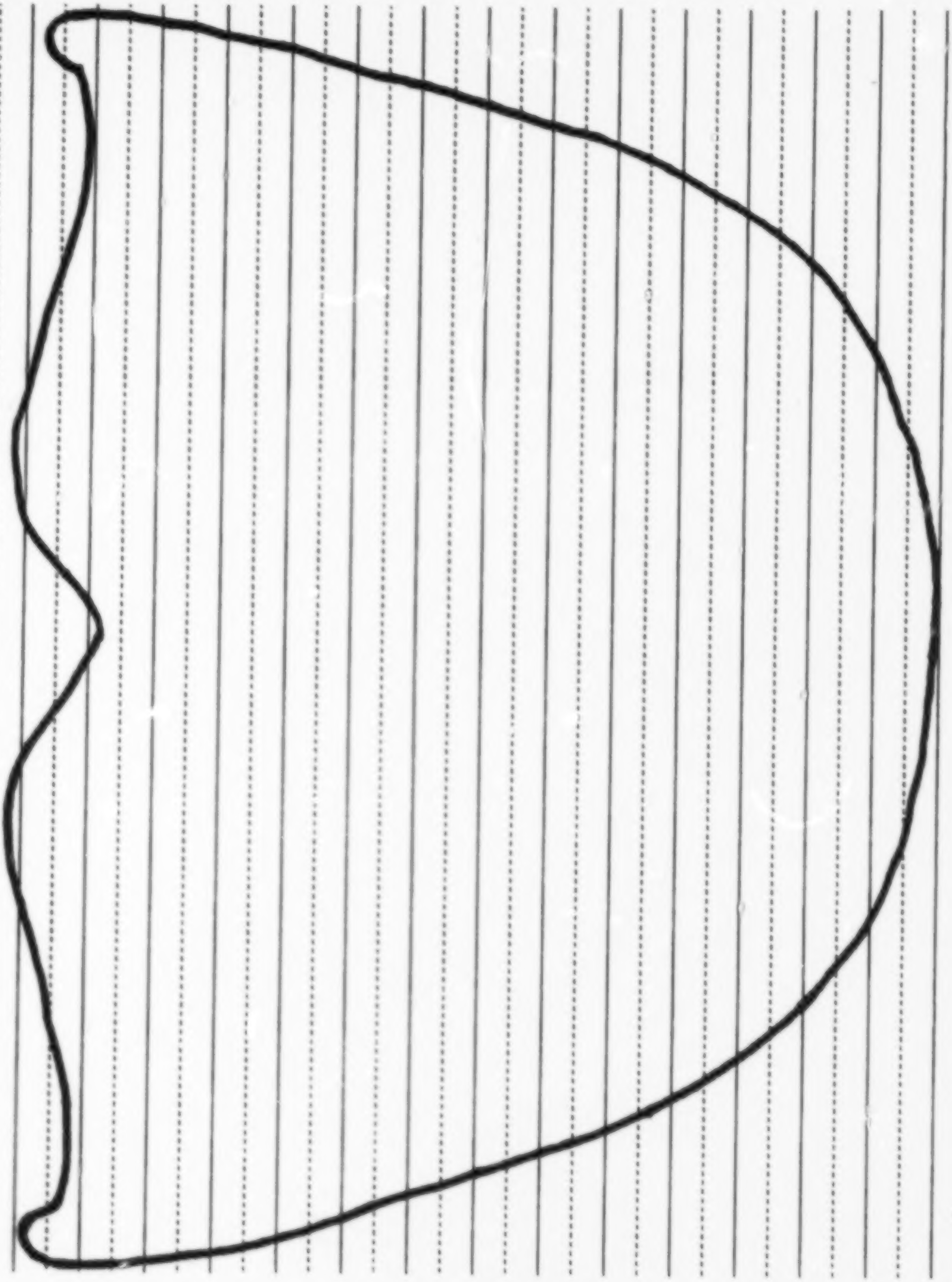


Diario de la Boca

____

Nombre

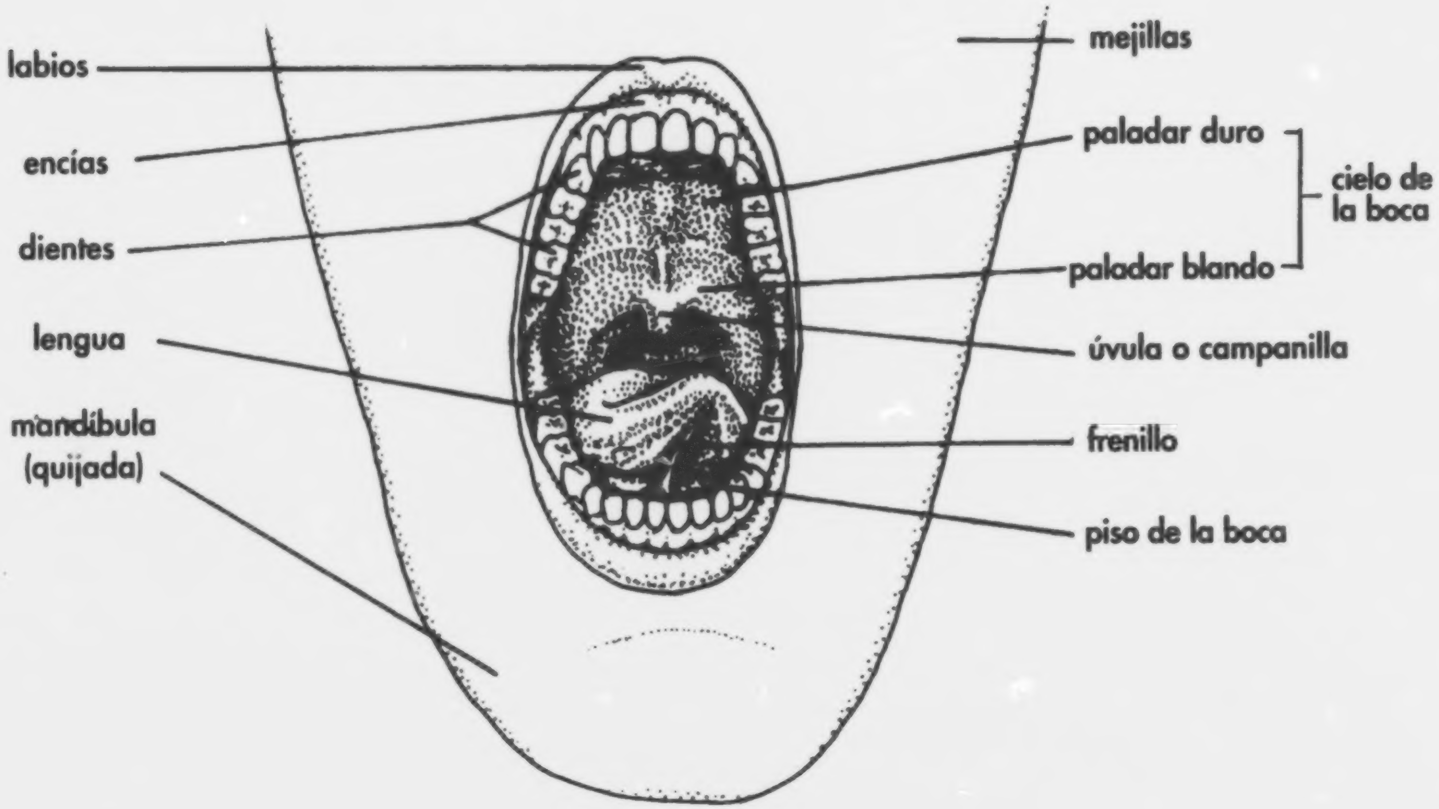
Hojas para el Diario de la Boca



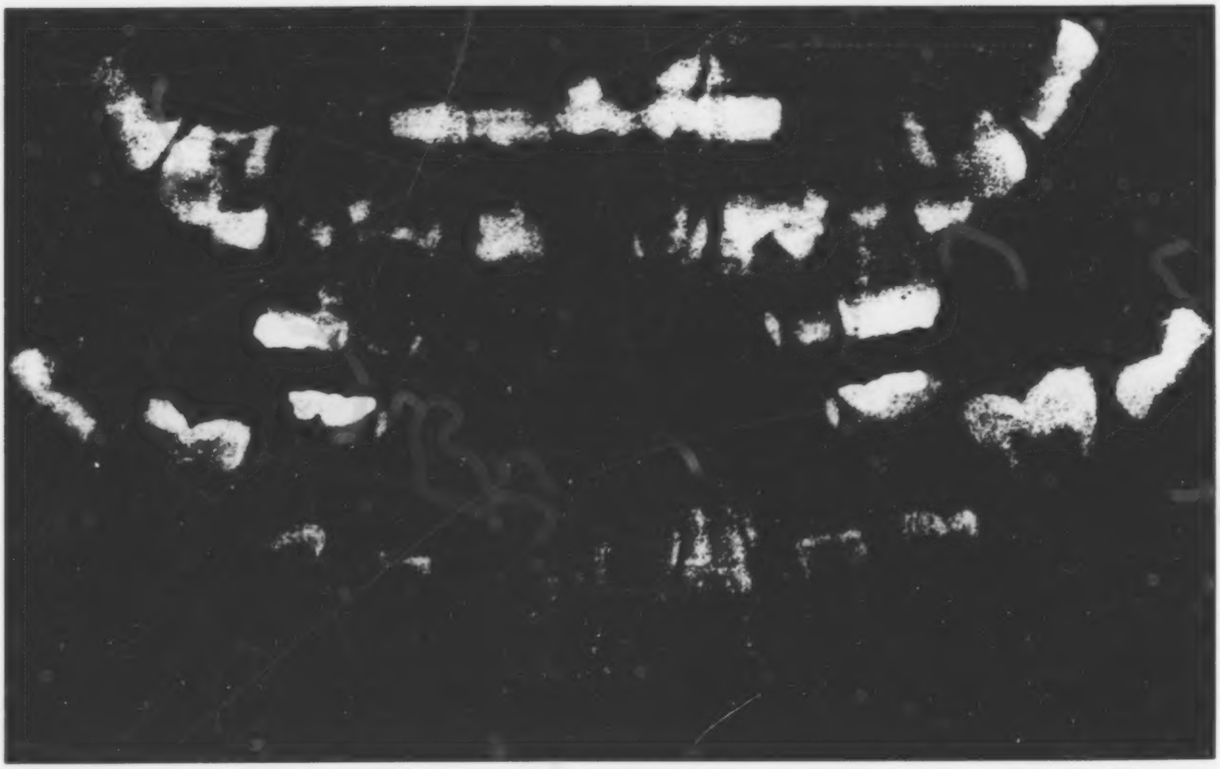
Patrón 1.3

Las Partes de la Boca

Patrón 2.1


labios
encías
dientes
lengua
mandíbula (quijada)
mejillas
paladar duro
cielo de la boca
paladar blando
úvula o campanilla
frenillo
piso de la boca

Radiografía de la Boca



Patrón 2.2

Tarea 1: El Registro de mis Dientes

Nota para los papás: Esta es la primera actividad que usted y su niño pueden hacer juntos en casa. Estas actividades para el hogar refuerzan lo que él está aprendiendo en la escuela. En cada hoja de actividades para el hogar hay instrucciones para usted y su hijo. Al reverso de cada hoja hay información importante para usted. Al terminar la actividad, llene el Certificado de Terminación y entréguelo en la escuela.

Su niño está aprendiendo en la escuela acerca de los dientes: cómo son los dientes, qué función tiene cada tipo de diente, y cuántos dientes y muelas tienen las personas en la boca. Antes de la lección gráfica en la escuela, asegúrese de contar el número de dientes y muelas que su hijo tiene.

Materiales

1 cepillo de dientes o un palito de una paleta
1 espejo

Procedimiento

1. Mírese con su hijo al espejo. Abran los dos la boca lo más que puedan. Observen los dientes y las muelas en ambas bocas. ¿Quién tiene más dientes y muelas? Escriba su respuesta en el Certificado de Terminación.

2. Mientras su niño se mira en el espejo, use el mango limpio de un cepillo de dientes o el palito de una paleta para señalar y contar sus piezas dentarias. Cuéntelas desde arriba y hacia abajo. Escriba el número total de dientes y muelas en el Certificado de Terminación.

3. ¿Le faltan piezas dentarias a su niño? ¿Tiene flojas algunas piezas? ¿Hay piezas que estén comenzando a salir? Mire en la boca de su niño y cuente cualquier pieza que falte, esté floja o sea nueva. Escriba sus resultados en el certificado.

4. Para divertirse, deje que su niño le cuente a usted sus dientes y muelas. Abra la boca lo más posible y deje que su niño cuente cada pieza con el cepillo de dientes o el palito de paleta. Pídale que le diga si una pieza dentaria es un incisivo, un canino o un molar. Haga que le diga para qué sirve cada una de estas piezas dentarias.

- -

Certificado de Terminación

(Llene este certificado y entrégueselo al maestro de su hijo)

¿Quién tiene más dientes y muelas? ____________________

¿Cuántos dientes y muelas contó usted en la boca de su niño? ____________________

¿Qué dientes faltan, están flojos, o son nuevos? ____________________

Firma del papá o guardián ____________________

Firma del niño ____________________

Hoja de Información para Papás

¿Se acuerda cuando le salió el primer diente a su hijo? Generalmente, el primer diente de leche (diente primario) aparece entre los 6 meses y el primer año de edad. A los dos o tres años de edad, la majoría de los niños ya tienen todos sus dientes de leche, que son veinte.

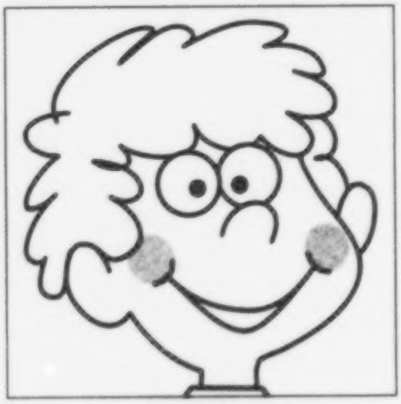
Su niño está empezando a perder esos dientes primarios. Como parte natural del crecimiento, las raíces de los dientes primarios se disuelven. Cuando los dientes permanentes empiezan a salir, se caen los dientes de leche.

Por lo general, a los niños les sale el primer diente permanente antes de empezar a perder sus dientes de leche. Atrás de las muelas de leche aparecen las "muelas de los seis años". Estos son los primeros dientes permanentes del niño. Cuando crezca y se convierta en adulto, estas muelas van a hacer el trabajo de masticar la comida, ayudar a hablar, y darle forma a la cara.

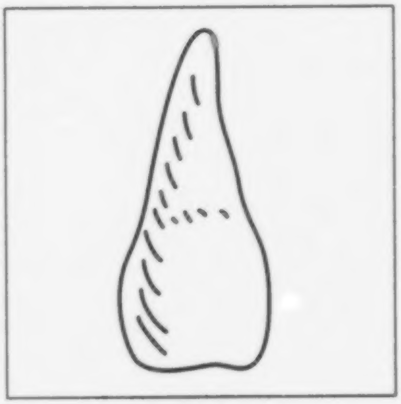
Estas muelas son tan importantes que merecen atención especial para que duren toda la vida. Los profesionales dentales recomiendan el uso de sellantes para proteger las superficies de masticar de las muelas contra las caries dentales. Los sellantes son capas plásticas finas que llenan las grietas que hay en la superficies para masticar, ahí en donde la comida se puede atorar. Los sellantes funcionan como una barrera física que protege a las muelas contra el ácido que causa las caries. Las muelas permanentes deben sellarse poco después de que aparecen en la boca y antes de que comience la caries. Además de mantener a las muelas en una condición saludable, el uso sellantes pueden ahorrar dinero, pues normalmente cuestan menos que las tapaduras. Los sellantes son inversiones excelentes para la salud bucal de su niño.

Patrón 2.3b

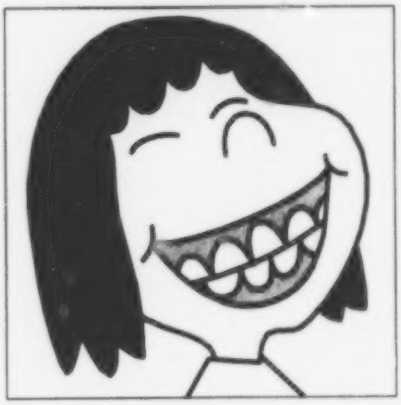
Las Partes de mi Boca: Juego de Cartas



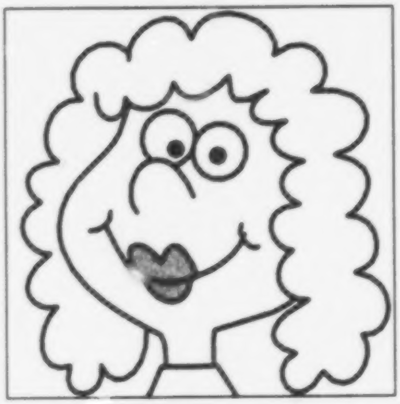
Mejillas



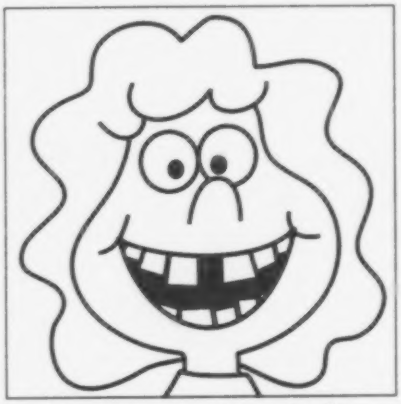
Incisivo



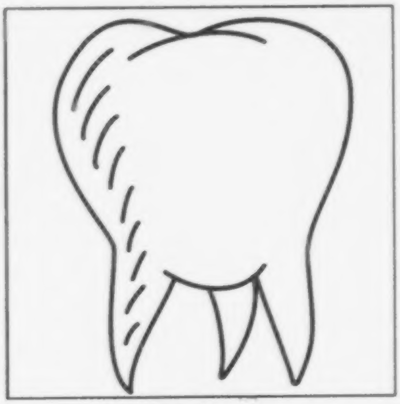
Encías



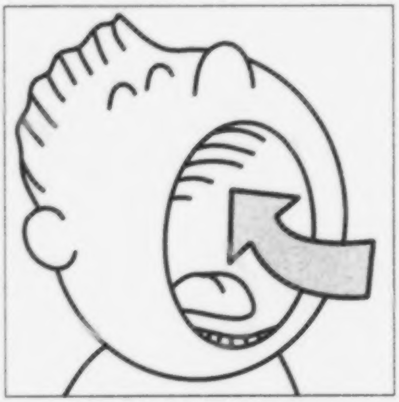
Labios



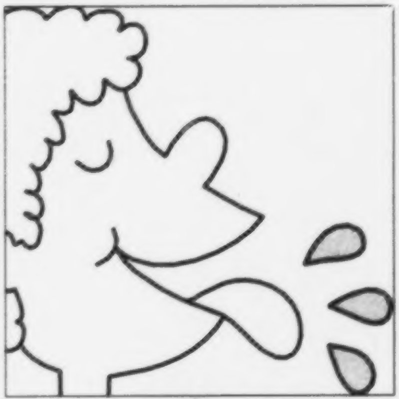
Un Diente Que Falta



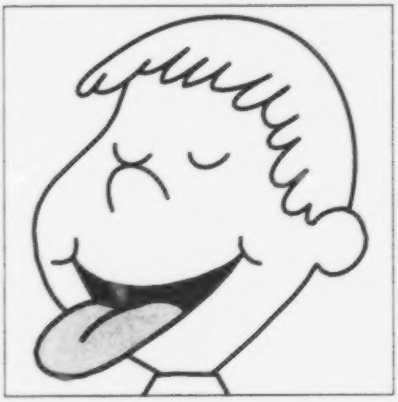
Molar



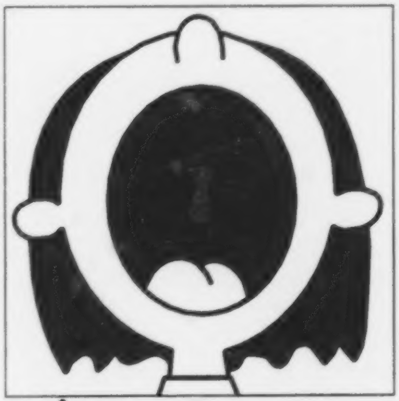
Cielo de la Boca



Saliva



Lengua



Úvula o Campanilla

Patrón 2.4b

La Manzana: Hoja de Notas

Nombres de los científicos ____________________ ____________________

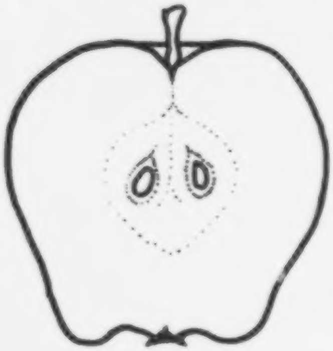
____

1. ¿Qué le sucederá a la manzana si ____________________________________

____

____?

2. Dibuje aquí lo que le hicieron a la manzana.



Escriba en este espacio lo que le hicieron a la manzana.

____

____

____

3. Esto es lo que creemos que va a sucederle a la manzana: ____________________

____

Patrón 3.1a

4. Registro de lo que le sucedió a la manzana:

Fecha	Manzana Experimental	Manzana Control

5. Esto le sucedió a la manzana después de _____ días: ________________

____

Patrón 3.1b

Tarea 2: ¡Así que quieres ser un gran científico!

En la escuela, su niño está aprendiendo a usar una manzana como modelo científico de los dientes para investigar la caries dental. En esta actividad usted va a usar un huevo como modelo para saber qué puede hacerle un ácido débil a una superficie dura como la de un diente.

Materiales

un huevo	una taza
vinagre	plástico de envolver (celofán)

Prodecimiento

Primer Día:

1. Primero observe al huevo. Mire la cáscara, tóquela. ¿Es dura o blanda? ¿Es suave o rugosa? ¿Está fresca o caliente? ¡Cuidado, no lo deje caer! ¿Se parece el huevo a un diente?

2. Ponga al huevo en una taza. Ayude a su niño a vaciar cuidadosamente el vinagre, que es un ácido débil, encima del huevo hasta que lo cubra completamente. Observe al huevo por 5 minutos. ¿Qué puede ver? Cubra la taza con el plástico. Deje al huevo en ese lugar sin moverlo por un día. Escriba en el Certificado de Terminación la fecha y la hora en que comenzó la investigación.

3. Discuta con su hijo lo que le puede pasar al huevo. Escriban juntos sus predicciones.

Segundo Día:

1. ¡Prepárense para ver el huevo! Escriba la fecha y la hora en el Certificado. Vacíe con mucho cuidado el vinagre en otra taza o en el desagüe. Observe al huevo. ¿Qué le sucedió a la cáscara? ¿Está dura o blanda? ¿Está suave o rugosa? ¿Está fresca o caliente? Discuta sus observaciones y escriba los resultados.

2. Suavemente, trate de hacer un agujero con un lápiz en la cáscara del huevo. ¡Cuidado! Hágalo en el fregadero. ¿Qué sucedió?

3. Conteste las preguntas en el Certificado. Después, tire el huevo a la basura. *No* se lo coma.

Certificado de Terminación

(Llene este certificado y entrégueselo al maestro de su hijo)

Fecha y hora en que se empezó la investigación: ______________________________

Esto es lo que predijimos que le pasaría al huevo: ______________________________

Fecha y hora en que acabó la investigación: ______________ El huevo estuvo en el vinagre _____ horas.

Así estaba el huevo al terminar la investigación: ______________________________

Hoja de Información para Papás

En esta actividad, usted investigará qué puede hacerle el ácido a un huevo. El huevo representa a un diente. Usted se preguntará: "¿En qué se parecen un huevo y un diente?" Como la superficie exterior de un diente, la cáscara de huevo es dura. Y ambos son blandos por dentro. De hecho, muchos de los minerales que hay en el esmalte de los dientes también los hay en la cáscara de huevo.

Los científicos a menudo usan modelos. Aunque no sea lo mismo que el objeto verdadero, un modelo ayuda a los científicos a aprender acerca de cosas que son muy difíciles de estudiar directamente en un experimento. Para investigar si un producto químico nuevo es seguro para las personas, los científicos frecuentemente lo prueban en ratones, ratas u otros animales. Los ingenieros de seguridad usan muñecos para probar la efectividad de los cinturones y las bolsas de aire de los automóviles. La información que los científicos obtienen usando modelos les ayuda a predecir situaciones reales.

En la escuela, los estudiantes usan manzanas como modelos de los dientes. En ellas perforan agujeros y ven qué sucede, especialmente alrededor de esos agujeors. En esta actividad, usted va a exponer un huevo a un ácido débil y verá qué le sucede a la cáscara. Estas dos investigaciones usan modelos con los que los estudiantes pueden hacer predicciones. Ellos podrán decir qué le pasará a un diente con caries (picaduras) o cuando se le expone a un ácido débil como el que nuestra bocas producen. También seguirán aprendiendo más acerca de los ácidos que causan las caries dentales. Trabajarán tal y como trabajan los científicos.

- -

¿Qué cree que le pasa a los dientes y muelas cuando hay ácidos en la boca?

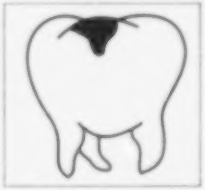
____

¿Cuál cree usted que es el mejor modelo de un diente o muela, la manzana o el huevo? ¿Por qué?

____

Firma del papá o el guardián ______________________ Firma del niño ______________________

Después de comer, las bacterias producen ácido. La placa hace que el ácido esté en contacto con los dientes. Si se queda en contacto con los dientes por mucho tiempo, el ácido puede hacerles agujeros. Cuando comes cosas con azúcar, las bacterias producen mucho más ácido. También crean más bacterias. Más bacterias producen más ácido. Y más ácido en tus dientes puede causar caries dentales o picaduras.



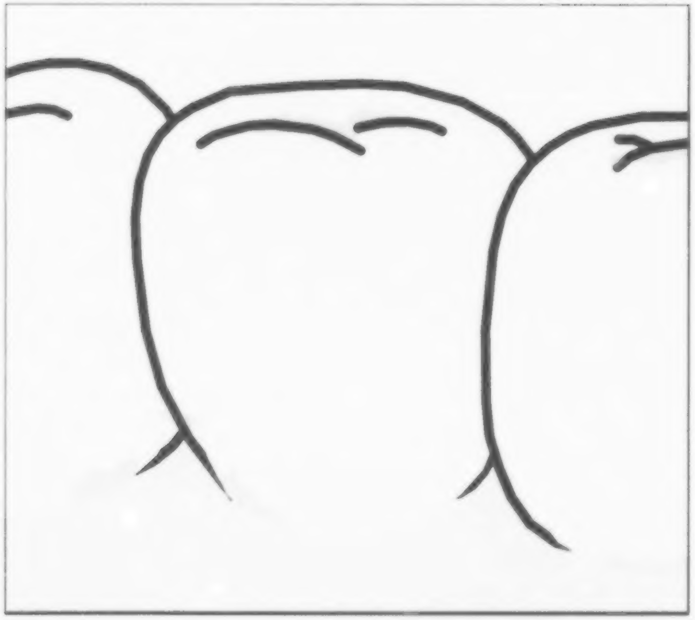
¿Ahora sabes por qué es importante cepillarse los dientes y comer comidas saludables y que no tengan tanto azúcar?

Patrón 4.1a

LOS ANIMALES COMEN Y BEBEN Y HACEN MUCHO MÁS

Los Animales Comen y Beben y Hacen Mucho Más

En casi todo el mundo hay animales. Algunos son muy grandes, otros son muy, muy, muy, muy pequeños. ¿Qué hacen los animales para sobrevivir?



Patrón 4.1b

Patrón 4.1c

Las bacterias viven juntas en grupos llamados colonias alrededor de los dientes y de las encías. Producen una cosa pegajosa que hace que se peguen a los dientes y que les ayuda a atrapar pedacitos de comida. ¿Has notado alguna vez que te puedes quitar una cosa blanca de los dientes al levantarte por la mañana o antes de acostarte en la noche? Eso se llama placa dental. Ahí es donde viven las bacterias. La placa es como una red con la que las bacterias atrapan comida y se pegan a ella.

Todos los animales comen algún tipo de comida, y todos consumen agua. ¿Sabes qué más hacen? Escucha este cuento y lo sabrás.

Los osos polares viven en las regiones heladas del norte. Comen carne de peces y focas. Y tienen ositos polares. Todos los osos polares hacen popó.

Cuando comes o tomas líquidos, las bacterias que viven en tus dientes y encías comen pedacitos de la comida que se queda en la boca. ¡Pueden guardar parte de esa comida y comérsela más tarde!

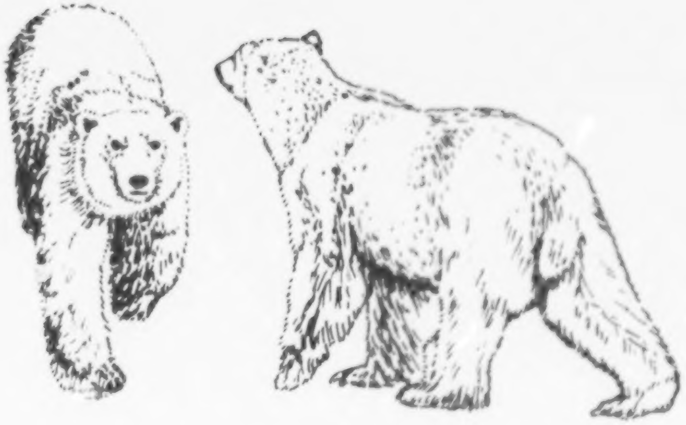
Algunas bacterias te ayudan a mantenerte saludable, pero otras producen un ácido que puede causar caries dentales o picaduras.

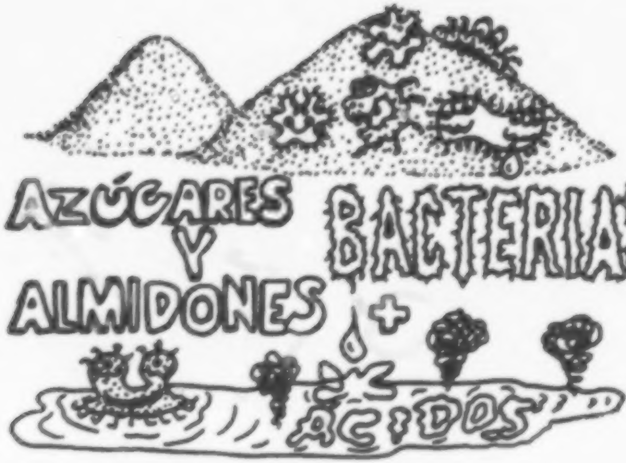
Patrón 4.1e

¿Que le sucede al ácido que producen las bacterias?

Si el ácido entra en contacto con los dientes por mucho tiempo, puede causar huecos en los dientes. Así es como ocurre.

Desde el día que naciste, distintos tipos de bacterias viven en tu boca y en la boca de todos. Las bacterias son muy, muy, muy, muy pequeñas. No se pueden ver a simple vista.




AZÚCARES
Y
ALMIDONES
BACTERIAS
+
ÁCIDOS

Patrón 4.1f

Revisemos.

Hay bacterias que viven en tu boca. Algunas comen lo que tú comes. Producen otras bacterias. Las bacterias producen un ácido.
¿En tu BOCA?
Sí, las bacterias producen ácido en tu boca.

Los ratones de campo viven en madrigueras en desiertos altos y praderas. Comen semillas y plantas. Y tienen ratoncitos de campo. Todos los ratoncitos de campo hacen popó.

Los guppys viven en las lagunas. Comen larvas de mosquitos y otros bichitos. Y tienen guppys. Todos los guppys hacen popó.

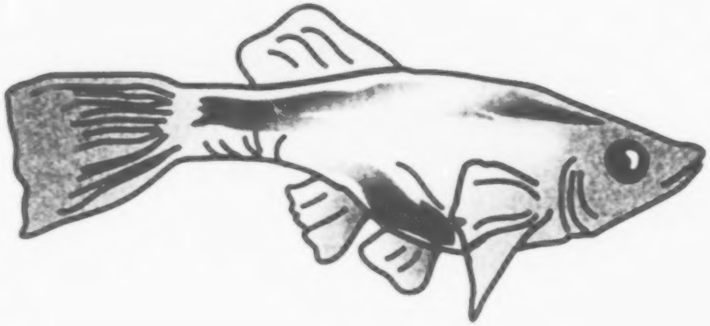
Bueno, otros animales hacen popó, como los osos polares, los ratones de campo, los guppys, y los gusanos. ¿Pero qué es la popó? Lo que nosotros llamamos popó es un desecho o desperdicio. Todos los animales producen algún desperdicio porque sus cuerpos no pueden utilizar todo lo que comen. Al terminar de comer, las bacterias producen un ácido. El ácido es la popó de las bacterias, su desperdicio.

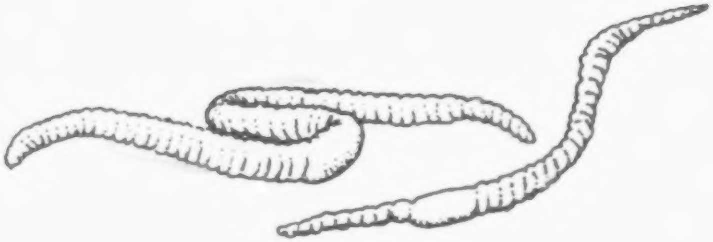
Patrón 4.1h

Patrón 4.1i

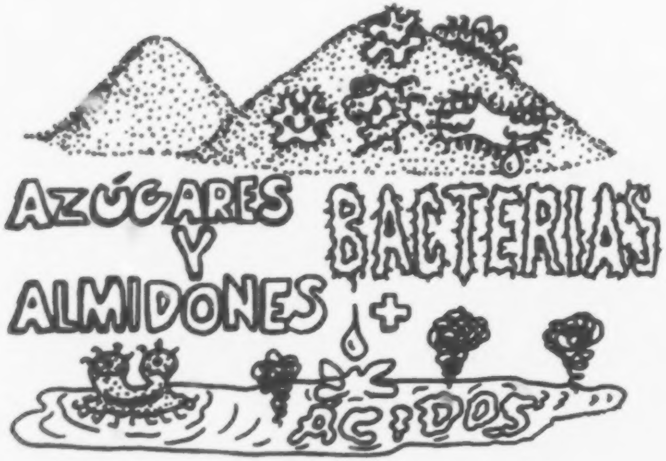
Así es que, las bacterias viven en tu boca.
Algunas comen lo que tú comes.
Producen más bacterias.

¿Hacen popó las bacterias?
¿En nuestras bocas?





Sí, esas bacterias producen más bacterias.
Y producen aún más bacterias cuando tienen cosas dulces para comer.


AZÚCARES
Y
ALMIDONES
BACTERIAS
+
ÁCIDOS

Patrón 4.1j

BEST COPY AVAILABLE

Hay bacterias que viven en tu boca. Algunas comen lo mismo que tú. ¿Esas bacterias pueden producir más bacterias?

Los gusanos viven en la tierra. Comen cosas que se pudren en la tierra. Y tienen gusanitos. Todos los gusanos hacen popó.

Hay bacterias que viven en tu boca. ¡Un momento! ¿Tengo bacterias viviendo en la **BOCA**? ¿Qué hacen en mi boca? ¿Estás seguro?

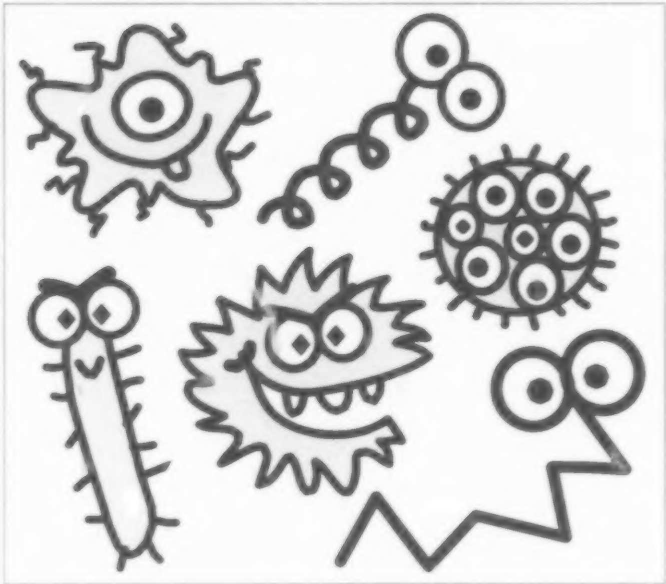
Patrón 4.11

Patrón 4.1m

Algunas bacterias comen lo mismo
que tú comes:
Emparedados de crema de cacahuete
con mermelada
Espagueti y queso
Pizza

Pero, ¿sabes qué es lo que más les
gusta comer?

Como casi a todos los niños, a las
bacterias que viven en tu boca les
gusta comer caramelos!



Algunas bacterias viven en sitios

oscuros,

calientes

y húmedos.

Algunas de esas bacterias viven en tu boca.

¿Qué crees que comen?

Patrón 4.1n

Tarea 3: ¡Cepillándose con Ritmo!

En la escuela, su niño está aprendiendo sobre las cosas que pasan en la boca y que pueden causar caries dental. Esta actividad le permitirá a su hijo practicar más cómo cepillarse los dientes para prevenir las caries. ¡Diviértanse juntos cepillándose con ritmo!

Materiales:
un reloj con segundero
cepillo de dientes y pasta dental con fluoruro

Procedimiento:

1. Mientras usted toma el tiempo, pídale a su niño que se cepille los dientes. ¡No lo deje ver el reloj! Dígale que deje de cepillarse cuando crea que ya pasaron dos minutos, el tiempo recomendado para limpiar los dientes completamente.

   ¿Cuánto tiempo se cepilló su niño? _________ ¿Fue más o menos de 2 minutos? __________

2. Cuando se usa la técnica correcta, es difícil no cepillarse por menos de dos minutos porque hacerlo bien toma tiempo. Revise con su hijo la técnica descrita en la Hoja de Información.

3. Es más divertido cepillarse con música. Piense en una canción simple y corta que usted y su niño puedan tararear de principio a fin, y apunte el nombre en el certificado. Después, tararee la canción. Use el reloj para ver cuánto tiempo le toma tatarear la canción una vez. Escriba el tiempo en el Certificado.

4. ¿Cuántas veces tendrá que tararear la canción para que le tome dos minutos? (Por ejemplo, si tararear la canción una vez le toma 20 segundos, tendrá que tararear la canción 6 veces para llegar a dos minutos. Si tiene que aproximar, calcule el tiempo máximo...¡Un poco de cepillado extra no hace daño! Anote en el certificado el número de veces que tuvo que repetir la canción.

5. ¡Ahora, haga la prueba! Pídale a su niño que tararee la canción mientras se cepilla los dientes. Ayúdele a contar el número de veces que repite la canción. Cuando se haya cepillado y tarareado el número de veces equivalente a dos minutos, puede parar.

6. Pídale a su niño que use esta técnica cada vez que se cepille los dientes. Su hijo se cepillará por dos minutos, el tiempo suficiente para quitar las bacterias que causan las caries dentales.

Certificado de Terminación

(Llene este certificado y entrégueselo al maestro de su hijo)

Nombre de la Canción: ____

Tiempo que toma tararear la canción una vez: __________________________

Número de veces que hay que repetir la canción para completer 2 o más minutos:__________

Firma de los padres ____

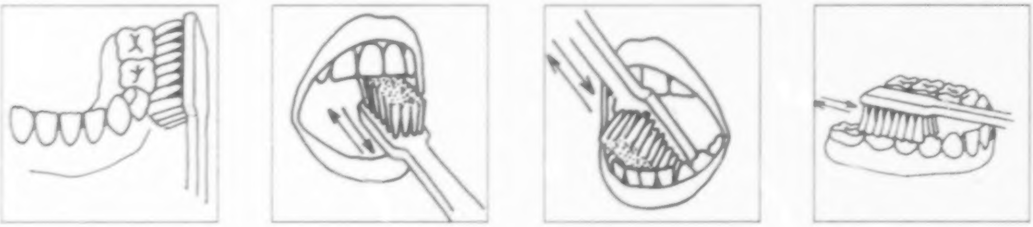
Firma del niño ____

Hoja de Información para Papás

Su niño está aprendiendo las cosas que pueden pasar en su boca y que causan caries dental. Platique con su niño sobre estos temas:

- Las bacterias que viven en la boca son organismos vivos.
- Como todas las cosas vivientes, las bacterias comen, se reproducen, y desechan desperdicios.
- El desperdicio que las bacterias desechan es un ácido que disuelve el esmalte de los dientes.
- A las bacterias les gusta comer más que nada azúcares y almidones o harinas. Cuando comemos más comidas que contienen azúcar, las bacterias prosperan y, como consecuencia, comen más, se reproducen más y producen más ácido.
- Para disminuir la cantidad de ácido en la boca, uno debe evitar comer golosinas y, sobre todo, alimentos y bebidas con azúcar. También debe cepillarse los dientes para eliminar las bacterias que, junto con los pedacitos de comida con que se alimentan, forman la placa dental.

Los profesionales dentales dicen que hay que cepillarse **por los menos dos minutos** para limpiar bien los dientes y quitar la placa dental. La Asociación Dental Americana (ADA) recomienda el siguiente procedimiento. Usando una pequeña cantidad de pasta dental con fluoruro y un cepillo de diente de cerdas blandas haga lo siguiente:



- Cepille la superficie exterior de los dientes con las puntas de las cerdas formando un ángulo contra el borde de la encía. Haga movimientos pequeños de lado a lado.
- Cepille las superficies internas.
- Cepille las superficies de masticar de las muelas, colocando el cepillo plano.
- Cepille la parte interna de los dientes de adelante, arriba y abajo.
- Cepille la lengua para quitar más bacterias.

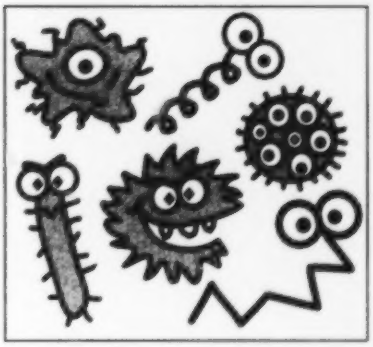
Para tener una boca saludable, es importante cepillarse los dientes por lo menos una vez al día, visitar al dentista con frecuencia, y mantener una dieta balanceada.

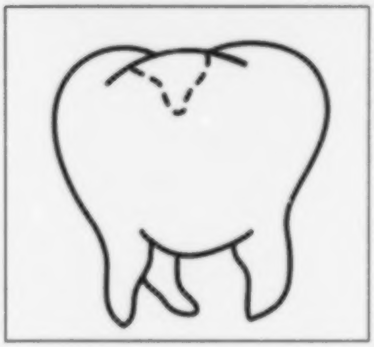
Patrón 5.1b

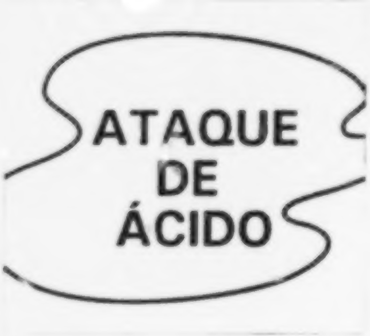
Un mal día para el Señor Diente (Guía)

1	2	3
4	5	6
7	8	9
10	11	12

Un mal día para el Señor Diente (Ilustraciones)



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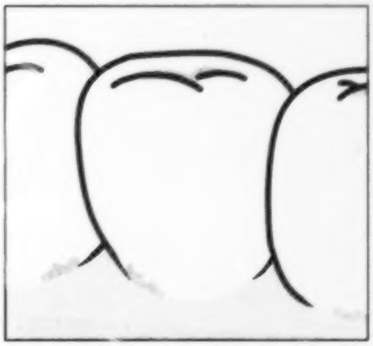

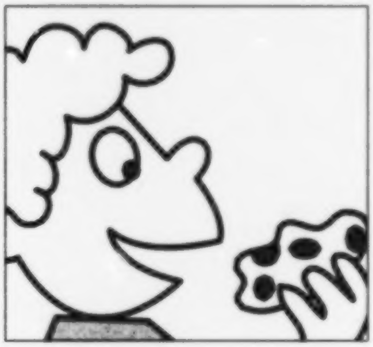

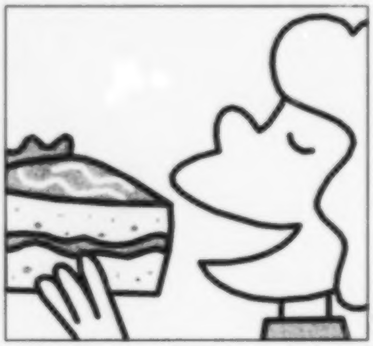

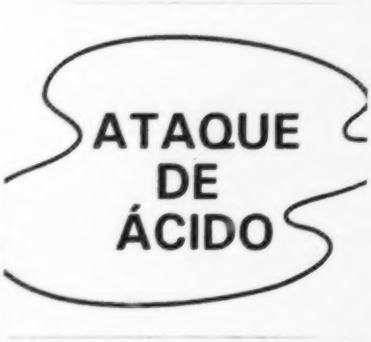
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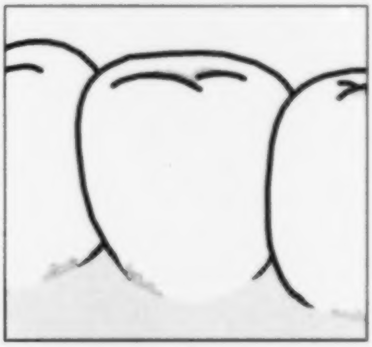
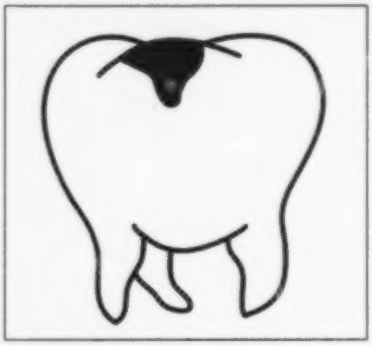
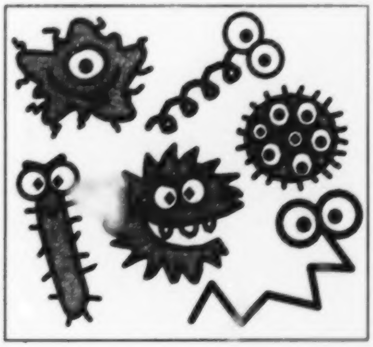
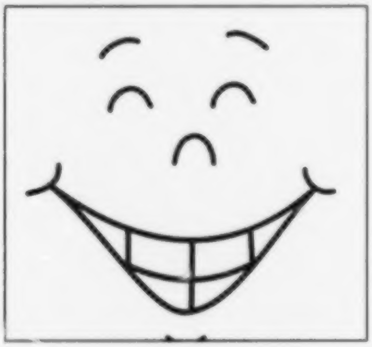
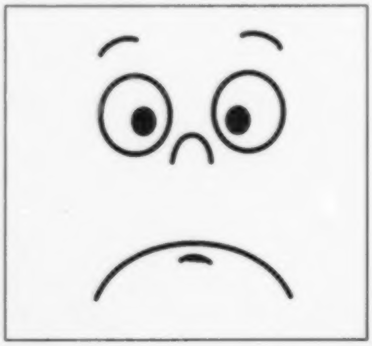






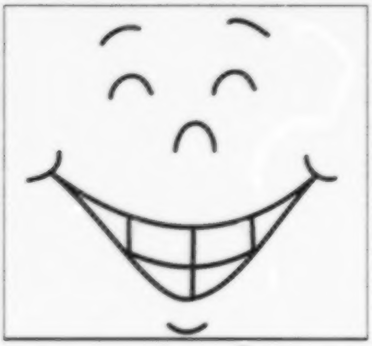


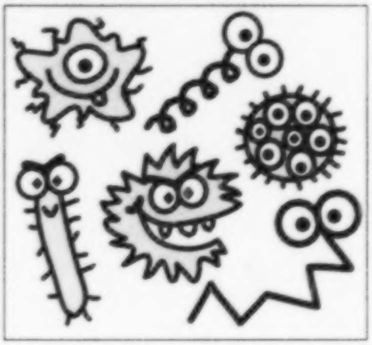


Un buen día para el Señor Diente (Guía)

1	2	3
4	5	6
7	8	9
10	11	12

Un buen día para el Señor (Ilustraciones)





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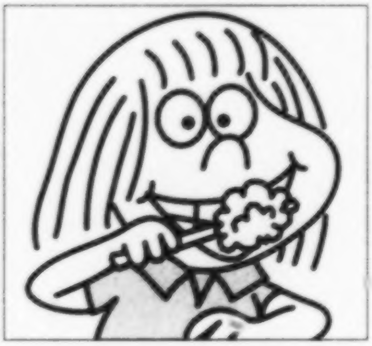

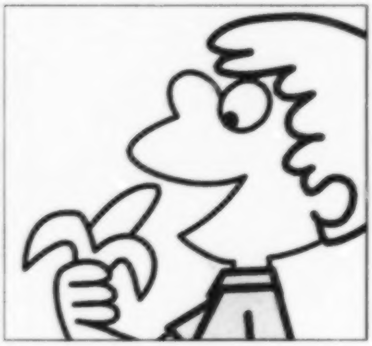

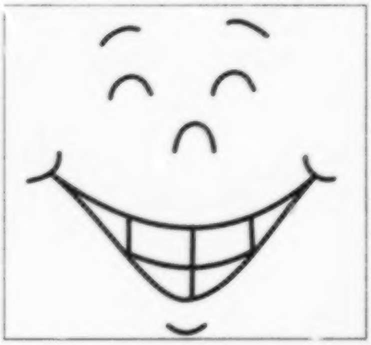

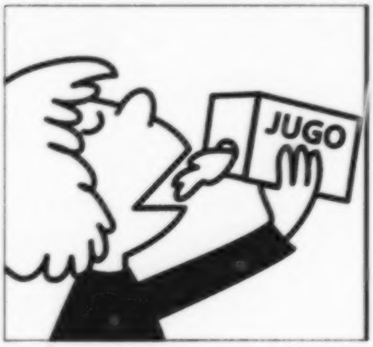

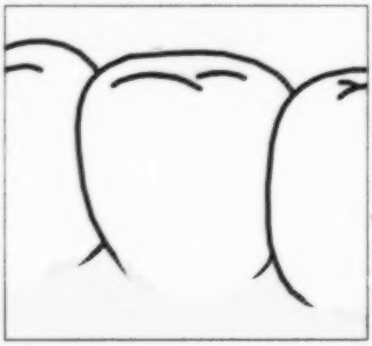

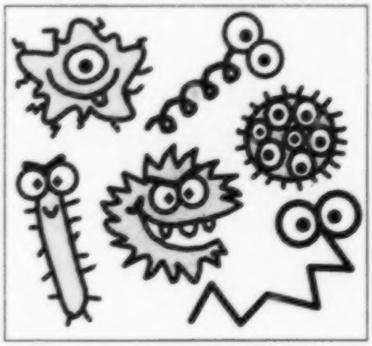

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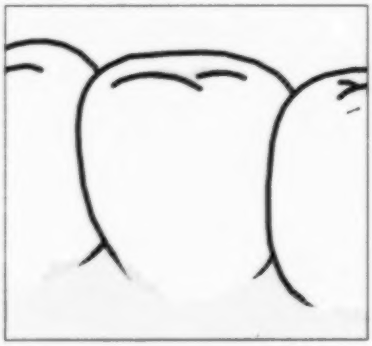

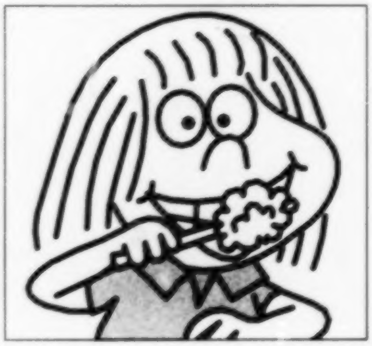

Patrón 6.4